Guidelines for the effective use of audio-visual technology in lecture rooms at North-West University

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DECLARATION

I, **David Chukuchane Taole**, declare that **guidelines for the effective use of audio-visual technology in lecture rooms at North-West University** is my own work and that all the views shared and expressed are my own. All the sources I have used or quoted have been indicated and acknowledged by means of complete references.

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To whom it may concern

This letter serves to confirm that the mini-dissertation with the title: ***Guidelines for the effective use of audio-visual technology in lecture rooms at North-West University*** has been language edited by the *Centre for Translation and Professional Language Services* (CTrans). CTrans is a registered corporate member of the South African Translators' Institute (SATI) that makes use of qualified and experienced language practitioners to provide professional translation and language editing services.

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Yours sincerely

Wendy Barrow

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Coordinator

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ABSTRACT

The use of audio-visual (AV) technology at institutions of higher learning has improved the methods and techniques used to deliver knowledge content to students. While these technological devices keep advancing in our society and daily lives, some institutions are not up to date with the evolving technological changes. The new generation of tertiary lecturers and students are dynamically involved in the use of these devices in their daily lives and it would also make it easy for them to use the same devices even in the lecture rooms for education purposes. However, some lecturers still struggle to effectively apply these technologies in their lectures.

The aim of this study was to develop guidelines for the effective use of AV technology in lecture rooms at North-West University (NWU). The study identified the different barriers that affect use of AV technology by lecturers in lecturing rooms. In situations where AV technology is available for use in lecture rooms, the barriers that led to lecturers not to make use of the equipment, were determined and guidelines were developed for effective use.

The study was conducted using an interpretive research approach, where the researcher applied grounded theory to understand the problems, situation and context of the research participants. The development and structuring of interview questions were guided by the literature review. The interviews with NWU lecturers were used to collect rich qualitative data. The collected data were analysed, coded, and categorised in order to develop themes and patterns that emerged from the participants. Interpretive content analysis method was applied to analyse the data and to develop guidelines for lecturers for the effective use of AV technology at NWU. The study outcomes reflect the barriers and challenges identified in the literature and the findings of the study in such a way that these guidelines should improve the effective use of AV technology in lecture rooms for lecturers.

Keywords: guidelines, audio-visual technology, lecture rooms

ABBREVIATIONS

AV	:	Audio-Visual
CCM	:	Constant Comparison Method
FNAS RERC	:	Faculty of Natural and Agricultural Science Research Ethics Regulatory Committee
ICA	:	Interpretive Content Analysis
ICT	:	Information Communication Technology
IT	:	Information Technology Department
NWU	:	North-West University
NWU RDGC	:	North-West University Research Data Gatekeeper Committee

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CHAPTER 1: INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

There are many forms of information and communication technologies (ICT) used by lecturers and instructors at colleges and universities (Idris *et al.*, 2018:33). Such technologies play an important role in today's world and are important tools that are used in classrooms to improve teaching and learning (Olafare *et al.*, 2018:5). There are many technologies and methods used in lecture rooms to conduct lessons, e.g. audio-visual (AV) technology and equipment. These are used to enhance student participation and skills development (Samra, 2013:610). Anderson and Horn (2012:58) are of the view that experts have accepted supporting information technologies as an important part of a student's education.

Technology used to aid teaching and learning should be effective and benefit both the lecturer and student. Lately, many students at tertiary institutions are a part of the new generation of technologically inclined citizens and, as such, they may even be more knowledgeable about new technologies than some lecturers (Emejulu & Mcgregor, 2019:132). For the benefit of students, lecturers must be able to use technology effectively in classrooms, in order to deliver good lectures. Yet, it should not make the lecturers' work more difficult. It is important to use technology appropriately in classrooms: students should get the best education, and lecturers should be able to deliver the best lecture. A university serves to teach and grow students' knowledge, using the best tools.

It is important for implementers of any form of ICT to fully understand the determinants of acceptance, so that they can plan effectively for it. While it is difficult to measure directly, for example, the contribution of information technology (as a subset of ICT), because of its hidden and intangible benefits, researchers have attempted to develop measures for this purpose. This study focuses on one aspect of a specific subset of ICT implementation in a teaching and learning environment. It focuses on the development of guidelines to assist lecturers in delivering a good learning experience by, for example, improving student participation and involvement in class, with the appropriate use of installed AV technology in lecture rooms at North-West University (NWU). Lecturers are the main users of AV technology in the lecture rooms. So, lecturers must accept and make good use of the AV technology to deliver content effectively to the students.

Lecturers must determine if the AV technology they need is installed appropriately, and if the installed AV technology is effective for use in their classes. The researcher uses interview questions to (qualitatively) determine lecturers' perceptions regarding usefulness of AV technology in classrooms at NWU, in order to create guidelines for improved use thereof. It must be noted that the term "AV technology" implies both AV technology and equipment from here onwards in this dissertation.

1.2 KEY CONCEPTS IN THIS STUDY

The key concepts of the study are guidelines, AV technology, and lecture rooms.

1.2.1 Guidelines

Guidelines are statements that aim to streamline a process in a particular direction or routine by making adaptable options available (Bates, 2000:71). In this study, guidelines are developed to guide lecturers to appropriately and effectively use the installed AV technology to conduct their lessons in lecture rooms in an optimal way. Guidelines, and the development thereof, is discussed in detail in Chapter 2.

1.2.2 Audio-visual technology

Technology can be explained as a collection of skills, techniques, processes and methods used to deliver a service and achieve the desired objectives (Bitner & Bitner, 2002:97). AV technology refers to a type of device that holds both sound and visual components. These are devices, such as projectors, computers, speakers, document cameras, interactive whiteboards, that may be used in lecture rooms for conducting lessons (Oppenheimer, 2003:6)(Maejima *et al.*, 2019:313). AV technology must be installed appropriately in lecture rooms for optimal use; it must also be used effectively by lecturers. They are detailed in Chapter 2.

1.2.3 Lecture rooms

Lecture rooms are defined as a type of room used for conducting lessons at institutions of higher learning; the setup is different from that used in pre-tertiary education, i.e. high schools and primary schools (Heggart & Yoo, 2018:10)(Meltzer & Manivannan, 2002:640). Institutions of higher learning include for example universities, colleges and university of technologies; the purpose and aim of the lecture room is to provide an

environment wherein to conduct a lesson to students (Bower *et al.*, 2017:410). The use of AV technology in lecture rooms is detailed in Chapter 2.

1.3 PROBLEM STATEMENT AND MOTIVATION

Information technology plays a crucial role to promote effectiveness in administrative as well as teaching and learning processes. Rapid technological developments prompt educational institutions to train the 21st century's generation to positively adapt to technological modernisations (Łuszcz, 2019:98). The need to do more with less, changing needs of society, and the impact of new technologies on teaching and learning, are some of the most important reasons that drive educational institutions to adapt (Serdyukov, 2017:8). It is important to use technology appropriately, in order to ensure that it promotes and creates learning opportunities for student achievement. The effectiveness of technology usage in different settings depends on the purpose of the activity. Technology on its own can never be transformative: in higher education, it requires that lecturers integrate it into the curriculum, use it for projects and align it with student learning goals and objectives (Goodchild & Speed, 2019:950). One of the most preferred technologies is a computer: it provides support for various technologies that use, for example, text and AV elements.

A study conducted by Franklin *et al.* (2001:26) identified the following barriers affecting the use of such technology by educators: vision, time, access, professional development and assessment. The study eluded that professional development support is needed to promote the integration of the curriculum with technology, and the redesign of the lessons around technological resources, to overcome the barriers of using technology. The different barriers are further discussed and expanded upon in Chapter 2.

NWU, as a higher education institution, has AV technology installed in lecture rooms. The AV technology is identified and perceived (non-)effective use thereof is explored by interviewing the participants, who make use of it for teaching purposes at NWU. Identified ineffective use and barriers are addressed in the guidelines so that lecturers may use installed and implemented AV technology more effectively for teaching purposes.

There are many stakeholders that should be involved in the dissemination, implementation and evaluation process of the guidelines. These stakeholders include, but are not limited to technical support, lecturers, students, and management

departments. The study is focusing on one stakeholder, whom are lecturers as they are the direct users of the AV technology installed in lecture rooms. The next Section discusses the research objectives and research questions formulated.

1.4 OBJECTIVES OF THE STUDY

The following objectives have been formulated for this study:

1.4.1 Primary objective

The primary objective of the study is to develop guidelines for the effective use of audio-visual (AV) technology in the lecture rooms at North-West University (NWU).

1.4.2 Secondary objectives

The secondary objectives are divided into theoretical and empirical objectives. They are discussed next.

1.4.2.1 Theoretical objectives

In order to achieve the primary objective, the following theoretical objectives have been formulated for the study:

- Learning about appropriate use of ICT, focusing specifically on AV technology, in lecture rooms at universities.
- Learning about barriers to the effective use of appropriately implemented AV technology at universities.
- Learning about the development of guidelines.
- Learning about interpretive research, as a chosen methodology for this study.

The researcher aims to gain and demonstrate an understanding of the key concepts of the study as contained in the theoretical objectives through appropriate literature reviews.

1.4.2.2 Empirical objectives

In accordance with the primary objective of this study, the following empirical objectives have been formulated:

- Gain an understanding of lecturers' perspectives on the AV technology installed in lecture rooms, and how it can be improved on for better use, at NWU.

- Develop guidelines from the perceptions and experiences of the participants, and also incorporating literature reviewed, for lecturers on how to effectively use installed AV technology in lecture rooms.

1.4.3 Research question

To achieve the study's objectives, the main research questions formulated are:

- How do the lecturers perceive the AV technology installed in NWU lecture rooms in terms of their teaching and learning experience, and how can it be improved?

- How can the use of AV technology in lecture rooms be improved or enhanced?

1.5 RESEARCH DESIGN AND METHODOLOGY

The study comprises literature reviews and an empirical study. Interpretive research is used for the empirical portion of the study. The choice of this research approach is motivated in Chapter 3.

1.6 LITERATURE REVIEW

A review of the literature is conducted using relevant online academic databases, journal articles and textbooks—refer to Chapter 2. The aim of the literature review is to enhance understanding of the key concepts and assist in developing the guidelines. Literature, in support of the empirical data collected, are used to develop the guidelines.

1.7 EMPIRICAL STUDY

According to Merriam (1998:34), qualitative research provides detailed narrative descriptions and explanations of phenomena investigated, with lesser emphasis given to numerical quantifications. Methods used to collect qualitative data include, for example, interviewing. Qualitative research that falls within the interpretive research paradigm, as described by Klein and Myers (2001:220); Merriam (1998:34), is conducted during the empirical part of the study. Semi-structured interviews are used to collect qualitative data. The collected data are then analysed and discussed. The researcher applies grounded

theory as the research method in the interpretive research paradigm. Empirical work is discussed in Chapter 4.

Grounded theory is a qualitative research design in which the researcher produces an overall description of a process, action or interaction, as compiled through the views of participants (Creswell, 2013:14; Strauss & Corbin, 1998:30). Grounded theory is a research method that seeks to develop theory that is grounded in data that were systematically collected and analysed. According to Martin and Turner (1986:142), grounded theory is a theory-finding procedure that allows the development of theoretical interpretation of common features of a topic by a researcher while preparing the experimental observations or data.

The major difference between grounded theory and other methods is its specific approach to theory development—grounded theory proposes that an uninterrupted relationship between data collection and analysis should exist. Grounded theory approaches have been successfully applied in information system research because of its phenomenon explanations, process orientated descriptions and context based development (Orlikowski, 1993:320). It is explored further in Chapter 3.

1.7.1 Participants

The participants of the study were NWU academic staff members lecturing on at least one module per semester. The number of participants was determined by the saturation of data for the study. In order to ensure voluntary participation of the participants, permission to be interviewed was granted by each lecturer who participated. Participants elected to participate by responding to a general request that was distributed via an official NWU distribution channel. A consent letter was sent in advance to make sure that the participant knew the nature and purpose of the study.

A purposeful sampling matrix as described by Creswell (1998:147) and Patton (2002b:276) was used to ensure inclusion of both junior and senior lecturers as participants. According to Patton (2002a:46), purposeful sampling is a method used in qualitative research for identifying and selecting participants to acquire information-rich aspects and do in-depth research. The researcher then includes participants according to the needs of the study (Morse, 1991:17).

1.7.2 Data collection and analysis

Interviews were conducted with lecturers to collect data, i.e. to explore their perceptions and identify barriers they encounter in the use of AV technology in lecture rooms and when teaching. Interview data were compared and integrated with the findings from the literature review. Interviews were conducted until data saturation. The collected data were analysed using interpretive content analysis. This is discussed in Chapter 4.

1.7.3 Rigour and evaluation of the method

In order to ensure that this study is of quality, and executed rigorously, a set of principles for interpretive field research, developed by Klein and Myers (1999:70), was used. These are:

- The fundamental principle of the hermeneutic circle. It is a principle that suggests all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form.

- The principle of contextualisation. It involves critical reflection of the social and historical backgrounds of the research setting, so that the intended audience can see how the current situation investigated emerged.

- The principle of interaction between the researcher and the participants. It entails critical reflection on how the research materials is socially constructed through the interaction between the researcher and participants.

- The principle of abstraction and generalisation. It needs relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.

- The principle of dialogical reasoning. It requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings with subsequent cycles of revision.

- The principle of multiple interpretations. It requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study.

- The principle of suspicion. It requires sensitivity to possible favouritisms and systematic alterations in the narratives collected from the participants.

Application of these principles to this study are discussed in Chapter 3.

1.7.4 Limitations

The study was conducted at one institution with three campuses in different locations; hence the results may not be generalisable to all higher education institutions.

1.7.5 Contribution of the study

The empirical contribution of this study is development of guidelines for the effective use of AV technology in lecture rooms at NWU. These guidelines are essential to a better understanding and improved technological skills development for lecturers for effectively using the installed information communications AV technology in their classes. The study focuses specifically on the use of AV technology, as a subset of ICT.

In addition, the findings of this study contribute towards the literature of ICT in the South African higher institutions' learning context. This study aims to assist lecturers with providing guidelines for effectively using AV technology in lecture rooms at NWU.

1.8 ETHICAL CONSIDERATIONS

The following processes were followed in making sure that the research adhered to ethical standards:

- Permission was gained to conduct the study at NWU.

- The researcher ensured that all participation was voluntary. Participants were informed about the study and asked to give consent.

- Participants were given access to the results of the study upon their request.

- All participants were treated respectfully.

- The information provided by the participants was kept confidential.
- The researcher followed the process prescribed by NWU for ethical research.

1.9 CHAPTER CLASSIFICATION

This study comprises the following chapters:

Chapter 1: Introduction and background to the study

The first chapter introduces the problem, motivates the study, and provides background to it. It includes the outline of the problem statement culminating in the objectives and outlining the research process.

Chapter 2: Literature review

The second chapter gives a literature review of the key concepts and what other researchers have found regarding them.

Chapter 3: Research plan

The third chapter discusses qualitative interpretive research and outlines the research plan. Furthermore, participants, data collection, data analysis, and rigour and evaluation are discussed.

Chapter 4: Data collection and analysis

The fourth chapter presents the study's findings and discusses the results. It also provides detail on the research process followed, generating of codes and creating themes.

Chapter 5: Conclusions, reflections and recommendations

The final chapter consists of a review of the complete study, and conclusions with regard to reaching the objectives. A set of guidelines developed is interpreted and explained in this chapter, and recommendations emanating from the study and some proposals for future research are made.

1.10 SUMMARY

This chapter introduced and motivated the study. It explained the research approach that was applied, and it also gave a brief chapter classification of the study. The literature review chapter is next.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of the study is to develop guidelines for the effective use of audio-visual (AV) technology in lecture rooms at North-West University (NWU). The purpose of this chapter is to give an overview of the existing fundamental aspects of developing guidelines, and effective use of AV technology in lecture rooms. The appropriate use of AV technology helps to improve student participation and involvement in class (Arbaugh, 2000:214). This is substantiated on the study conducted by Akhtar *et al.* (2017) when they reported on the purpose of computer aided design, blended learning, student monitoring and the learning analytics. The successful integration of AV technology in lecture rooms depends on many factors. These factors play an essential role in the integration process because they can either promote or impede it. The literature on these factors is presented in all possible contexts. In the context of this study, this chapter also aims to identify factors encountered by lecturers when integrating technology in their classrooms and how they can be resolved.

The chapter is divided into four sections. Section 2.1 gives the introduction of the chapter and its layout. Section 2.2 focuses on the fundamentals related to the development of a guideline. A guideline is defined, its purpose and use are clarified, and it is explained, both generally and in the context of the study. The process of determining an effective guideline is presented and the key principles of developing a guideline are explained. Section 2.3 discusses AV technology in lecture rooms. The definition of AV technology is discussed, both in general and in the context of the study, and its purpose is explained. The effective use of AV technology and factors that impact upon successful integration thereof in a classroom are expanded upon, in order to give an overview of effectiveness. These factors are discussed in the context of the study and as to how they can be improved on. Lastly, barriers that affect integration in the classroom are discussed. Section 2.4 is the summary of the chapter.

2.2 GUIDELINES

Guidelines can be considered as strong or weak (conditional or discretionary), depending on the quality of their supporting evidence (Dhakal, 2009:4209). Guidelines draw on the theory and practices of giving recommendations for implementing a process that would

enable effective implementation and evaluation (Craig *et al.*, 2011:1). The balance between achievable and non-achievable outcomes are alternative options that are based on how users must implement the guidelines (Guyatt *et al.*, 2014:385). This section briefly explores the history and evolution of guidelines in a general context and then expands it to the context of the study. A definition of guidelines is discussed next.

2.2.1 What is a guideline

Lohr and Field (1990:66) and Hibble *et al.* (1998:862) say a guideline is written material that provide guidance or an indication of a course of action; it is a step by step process to achieve an outcome. The Chambers 21st Century Dictionary (2017) refers to a guideline as an indicator of a course that should be followed, or of a future action that is required or recommended. According to Peltier (2016:71), guidelines are general statements designed to achieve objectives and provide a framework of how to apply them. Guidelines can also be a set of optional instructions or recommendations aimed to ensure that a process yields the best possible outcome (NHMRC, 2011).

In essence, guidelines are a summary of the best available options, presented in a useful format so as to guide someone who is using them (Turner *et al.*, 2005:162). Guidelines represent good quality recommendations and are available across different fields and areas (Grilli *et al.*, 2000:104). According to Eccles and Mason (2001:1), guidelines are useful tools to consistently and effectively bridge gaps between the scientific evidence supporting improvement, and the implementation of practices for improvement. This is also supported by Burgers *et al.* (2003a:148) and Gopalakrishna *et al.* (2013:79), when they say that guidelines are a set of systematically developed statements to assist individuals to make decisions regarding a procedure. Guidelines have become a common feature in different area scopes and the worldwide interest has increased (Woolf *et al.*, 1999:528). The purpose of a guideline is to facilitate a more consistent, effective and efficient process, to improve an outcome (Kamat, 2004:157).

The study focuses on how to effectively use AV technology installed in lecture rooms. A guideline in this context is thus defined as recommendations or process steps that give direction on how to achieve this required output and result. So, process steps and recommendations are needed to be used to achieve the desired output or result. The purpose of guidelines is discussed next.

2.2.2 The purpose of guidelines

According to Shekelle *et al.* (1999:593), guidelines serve different purposes in a wide range of areas. Tito and Newby (1998:87) say that a guideline does not directly encourage or hinder a process, but rather assists one to make an informed decision based on the available information. The purpose of a guideline is to clarify and give necessary recommendations. However, Graham *et al.* (2000:284) argue that guidelines oversimplify instructions and does not assist the intended user to learn by means of the difficulties of not having a guideline. In criticising guidelines, Farquhar *et al.* (2002:503) also point out that they reduce the possibility of users making mistakes and exploring other options. Still, the purpose and intention of having a guideline is advantageous for the future because everything gets documented and updated according to changing environments and situations.

A guideline should be used for, but not limited to, simplifying instructions and processes; it must be adapted for different scenarios and circumstances that the user intends to use it for. As stated by Shekelle *et al.* (1999:593), a general guideline can be used in different fields and can be implemented differently to suit the needs of the user. Turner *et al.* (2005:160) and Ellison *et al.* (2006:436) say that a guideline should be outcome focused, incorporate the most possible and applicable recommendations and be developed based on the needs of the user to make the process simpler. The purpose and benefits of a guideline are determined by the characteristics and qualities in the guideline itself (Trepanier *et al.*, 2017:211). This means that a guideline serves its purpose if it satisfies the needs of assisting in decision making, processing steps or giving recommendations.

Guidelines can be categorised using different keywords, e.g. practices, position statements, process steps, procedures, methods and techniques (Boon Harold Tan, 2006:196). Under Article 29 of the Data Protection Working Party (A29, 2014:12), a guideline consists of information collected and organised to give direction in different spheres. Guidelines should have a target audience, and should meet and satisfy the needs of the user (Loane & Wootton, 2002:63). The best practice is to develop flexible guidelines even for general use, but they should maintain certain standards in the development and implementation process.

Guidelines seek to change behaviours and mentality of users by setting standards and procedures of how processes can be concluded (Tu & Musen, 1999:421). A guideline can be used to make decisions and try alternative solutions to find the best suitable possibility (O'Flynn *et al.*, 2014:314). The use of a guideline aids to sequence and synchronise action steps for users. In this study, the purpose of developing guidelines is to establish standards that will be used to measure the effectiveness and use, as perceived by lecturers, of AV technology installed in lecture rooms. The uses of guidelines are discussed next.

2.2.3 Uses of guidelines

Shekelle *et al.* (1999:593) believe that guidelines can be used and implemented in various ways. Grimshaw and Russell (1993b:1321) and the NHMRC (1999) say that guidelines should improve the quality of the process by stimulating effective recommendations and evaluating the process. According to Howard and Jenson (1999:285), guidelines assist one to follow a defined set of procedures to achieve the desired outcome. This reduces the common experimental steps one takes to explore solutions and endorses the more effective and reviewed methods (Koch *et al.*, 1995:48; Walker *et al.*, 1994:236). The use of guidelines must reliably reflect the large areas of uncertainty in the organisation of many challenges and not attempt to overpower the strong differences that arise in times of implementation (Ari & Fink, 2011:563).

Guidelines are often not used accordingly because of a stereotypical belief of end users: some users believe that guidelines developed locally are less credible than those from internationally recognised experts (Sommers *et al.*, 1984:1130). The use of guidelines should clearly reflect the basis of each recommendation and the degree to which they satisfy the needs of the intended user (Grimshaw *et al.*, 2004:2). In the development and application of guidelines, there will always be new developments that arise due to the changing environment, hence guidelines should be tested extensively to attempt and accommodate such changes (Turner *et al.*, 2005:160). Guideline developers need to learn that in order for an instruction to be considered acceptable, it should be reliable and used to improve the process quality in any way possible. In order for a guideline to be used, it does not have to be developed by an expert only, but any developed guideline can be used as long as it satisfies the needs of the intended users. A guideline can never

cover everything and be the only option to get the desired result, but it can be used to explore other possibilities when it is expanded further (Fix & Bokhour, 2012:273).

Mahalepa (2016) conducted a study on developing guidelines for business intelligence modules in information technology programmes at universities using critical systems heuristics and discussed the differences between a guideline and policies and laws. He states that a guideline can be used as a recommendation, proposal, advice, specification and suggestion. He then continues by saying policies and laws are code of conducts implemented and enforced by an organisation or government. Guidelines usage differs, however, to the extent in which they generate better quality outcomes in different fields (NHMRC, 2000). A potential tool that can be used to standardise a process by improving the quality and the effectiveness thereof, is a guideline (Peleg *et al.*, 2000:645). Oxman *et al.* (1995:1424) say there are no simple answers when it comes to development and usage of guidelines, but instead the cycle of development, application and evaluation of consumer feedback is significant to determine the success or failure of a guideline. The objective of the guideline development usage process should be intended at detecting involvements that will guarantee the best potential outcomes (WHO, 2004:2). Guidelines become recommendations whenever the standards are mandatory steps to be followed and used (Peltier, 2016:9).

A guideline is usually used to describe a defined process by breaking the process into sub-sections. When using a guideline, an individual has their own expectations that must be met and satisfied. The process of developing guidelines is laborious and mostly expensive (Hulshof & Hoenen, 2007:26). However, most guidelines are not regularly used, even though they were aimed at being implemented and used. A guideline must consist of certain attributes for it to be regarded as effective (Haines & Feder, 1992:785). Any guideline can be considered good, but it must achieve the purpose of what it is developed to do. The attributes of a good guideline will determine the effectiveness (Grol & Grimshaw, 2003:1228). The effectiveness of guidelines is discussed next.

2.2.4 Effective guidelines

Guidelines are considered effective when they articulate each part of the complex sequence of development, dissemination, implementation, and evaluation (Grimshaw & Russell, 1993a:243). A guideline is deemed effective when the recommendations are

followed and used in the correct order and the implementation process is also successful (Burgers *et al.*, 2003b:17). Any guideline can be deemed good, but an effective guideline is clear, precise and easy to adapt to any scenario of the intended user by addressing the problem at hand or improving the process. An effective guideline is not static, but updated frequently to keep up with new demands of ever changing challenges (Haines & Feder, 1992:786).

Guidelines are effective when they are perceived to be beneficial and are actually used for decision making by the intended users (Bates *et al.*, 2003:529). The effectiveness of guidelines is determined by the outcomes or recommendations obtained from the evaluation process (Graham & Harrison, 2005:70). When the guideline development process involves data collection of the intended outcomes from the intended users, the distribution and application of the guideline will be effective (Durlak & DuPre, 2008:349; Ploeg *et al.*, 2007:211). Effective guidelines can be presented in different formats: free text, flow charts or in any other format to simplify the understanding of the content (Duke & Pearson, 2008:121). Attributes of a good guideline include it being precise and unambiguous; readable; logical and with a specified sequence; and adaptable and flexible to different scenarios (Peleg *et al.*, 2000:645).

Figure 2-1 shows the steps and processes that must be followed in developing effective guidelines. There are many factors that can influence the effectiveness of a guideline development process; hence reviews occur in most of the steps to be up to date with new developments and changes (Rae-Grant *et al.*, 2018:778). When each step of the chain of development is not evaluated, as shown in Figure 2-1, the guideline developers will not know exactly which chain in the link is ineffective and that will mean that intended users will not get satisfactory outcomes when using the guideline (Millward *et al.*, 1993:222).

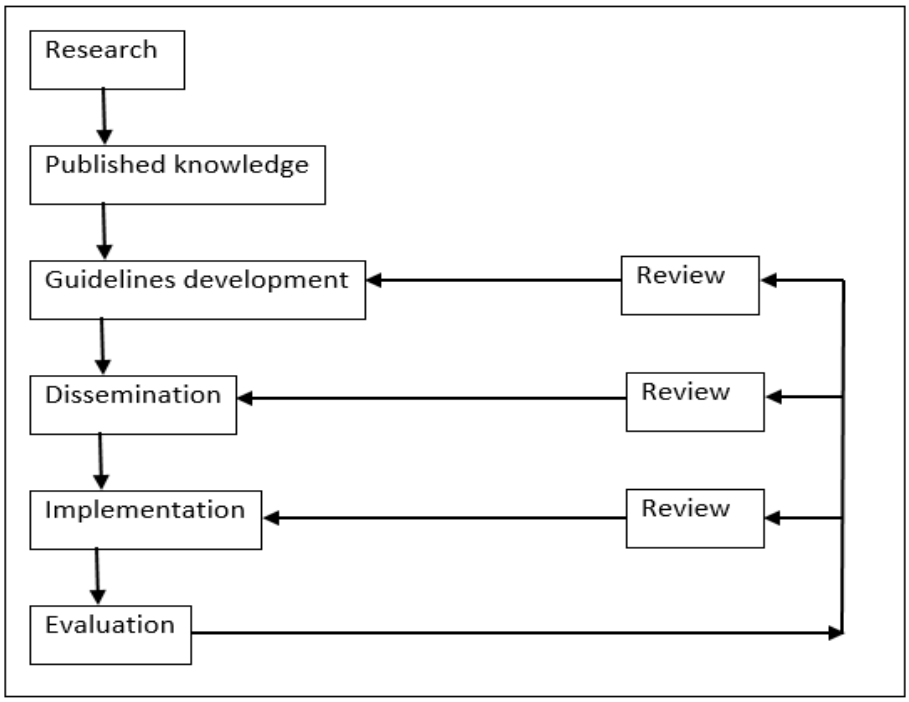

Figure 2-1: Chain of events to produce effective guidelines (Thomson *et al.*, 1995:237)

2.2.5 Key principles of a guideline

According to Bartram (2001:35), a good guideline should possess these two key principles: consistency and acceptability. Any guideline development process should be based on certain standards and principles so that the guideline can exclusively address the research issues (Stuart *et al.*, 2002:432). These principles can be adopted and adapted to any study concerned and implemented towards the purpose of the research. The National Health and Medical Research Council of Australia (NHMRC, 2000:5) recommended nine principles for developing guidelines. The guidelines are general and can be adopted where applicable to be more specific to the field and study focus (Silagy *et al.*, 1998:3). In this study, these principles were adopted to assist in the process of developing guidelines for the effective use of AV technology in lecture rooms at NWU. The nine principles and how the researcher of this study aimed to adopt them are discussed next.

Principle one: Guidelines should be outcome based. In developing guidelines, expert and consumer advice are critical in determining the most appropriate outcomes and expectation (NHMRC, 2000:9). This means that before a guideline is developed, there must be an objective and goal on what the guideline is expected to achieve. According to

Shekelle *et al.* (2001:1463), guidelines must categorise significant decisions and their impacts and should assess the outcomes of alternative decisions.

Outcomes and results regarding AV technology in lecture rooms must be used to improve the dissemination and implementation of technology for lecturers. This step can be done by confirming continuously throughout the guideline development process that they adhere to this objective, as it was the main focus of the study. Guidelines that are outcome focused should assist the researcher (and guideline developer) to always carry out the process based on the outcomes of the study.

Principle two: A guideline should be based on the best available evidence. Guidelines are intended to assist their target audience in decision making by exploring the wide range of generally suitable approaches with evidence to support the approaches (Bonow *et al.*, 2006:8). Guideline users must know to what extent they may feel confident about the information and recommendations (Atkins *et al.*, 2004:1490).

When developing guidelines in this study, available evidence collected from interviews should be regarded as important as it will serve as the evidence that guides the development process. These formulated findings and the empirical data that the users provide should play a crucial role in giving other possible recommendations. The optional recommendations cannot be limited to the available data, but the experiences of users must be taken into consideration.

Principle three: The method used to synthesise the available evidence should be applicable and relevant. The Institute of Medicine Committee (Field & Lohr, 1990:53) discovered that there is no explicit method available to assess guidelines, but instead a method is adopted according to its qualities, reliabilities or validity. Information disseminated to consumers should be easy to use for it to be regarded as guidelines (Farquhar *et al.*, 2002:503).

When making recommendations, it is necessary to include all the available information, whether it is supporting or contradicting the study. This simply means that in developing guidelines for the effective use of AV technology in lecture rooms, the process must include data analysis (i.e. coding and theme generation) to include all the different views of users.

Principle four: The guideline development process should combine several disciplines and include consumers early in the development process. Ulwick (2002:93) and (Armstrong *et al.*, 2018:186) believe that consumers do not really know what they want when they are asked, but consumer research helps to increase the chances of success in the market for any new development. Wiering *et al.* (2017:636) also confirm that for new developments, the developer should get a clear understanding of the consumer voice.

For the purpose of this study, the development of guidelines is intended to assist NWU lecturers on how to effectively use the installed AV technology in lecture rooms. The views of lecturers must be represented and explored in the process of developing these guidelines. This stage must be revisited regularly to make sure that the process still complies with the university's standards and meet the lecturers' needs for conducting their classes.

Principle five: Guidelines should be flexible and adaptable to changing developments. A quality enabling effective process includes existing recommendations and is not rigid or resistant to new options (Heidenreich *et al.*, 2014:470). Available guideline alternatives should be flexible and allow for modifications regarding new developments that may arise (Broman & Robèrt, 2017:19).

The developed guidelines in this study should make clear recommendations for the effective use of AV technology in lecture rooms at NWU. The developed guidelines should allow for a flexible implementation at any of the three campuses of the NWU. The implementation from one campus to another will differ according to the demographics and resources available in the lecture rooms.

Principle six: Guidelines should be developed considering resource constraints and implications. Guideline developers must be wary of the necessary resources required for development and application of guidelines (NHMRC, 2000:12). Easy to understand guidelines have a greater chance of being implemented because they do not require any specific resources (Davis & Taylor-Vaisey, 1997:409; Francke *et al.*, 2008:40; Grilli & Lomas, 1994:203).

The resource constraints that affect the effective use of AV technology in lecture rooms must be identified from the empirical data collected in the interviews at NWU. It is important to identify the constraints and their implications. These guidelines must be reviewed regularly to make sure that the constraints are addressed.

Principle seven: Guidelines must be developed, disseminated and implemented taking into account their target audiences. When the audience is aware of the existence of a guideline and are familiar with its content, then it is easier to implement it (Francke *et al.*, 2008:2). The complexity of a guideline has a direct impact on the implementation because users need clear basic steps for using developed guidelines (Gertler, 2017:354). Sachs (2006:40) added by saying that when a guideline is developed for a target group or experts, it improves the chances of effective implementation.

The guidelines must aim to clarify the *What*, *Where*, and *How* processes. *What*: "what does the technology do?"; *Where*: "where will it be installed?"; and *How*: "how to use it effectively for your lesson?" Guidelines should be developed in such a way that the target audience understands the terminology clearly, to avoid misunderstandings during implementation. This principle goes together with principle four because it involves the needs of the target audience.

Principle eight: The implementation and outcome of the guidelines should be evaluated. According to Field and Lohr (1992:48), guidelines can never be implemented in isolation. Guidelines must be evaluated by a multidisciplinary panel that oversees all the implementation and dissemination steps (Harber *et al.*, 2008:1283). In doing so, the guidelines can be deemed effective when rigorous tests have been done (Smith & McGannon, 2018:103).

Evaluation is a continuous process that should be done throughout the study because the outcomes determine if the implementation process is successful. This process is important in determining the different methods and the best possible outcome and results that can be produced. The purpose and intended outcome of the study is to develop effective guidelines for the use of AV technology in lecture rooms.

Principle nine: Guidelines should be updated regularly. Guidelines change over time and their recommendations should be kept up to date (Agha *et al.*, 2018:133). Rapidly

evolving fields require guidelines to be reviewed regularly and updated according to new information (Shekelle *et al.*, 2001:1465).

Guidelines are based on available data and knowledge. They must be regularly updated, reviewed and modified because of new research, and technologies that arise as a result of the evaluation of guideline outcomes. This principle should be applied as a recommendation in the last chapter.

The purpose of this study is to develop guidelines for the effective use of AV technology in lecture rooms at NWU. The process of developing guidelines has been identified, along with the key principles to guide the development process. AV technology in different areas and how it is applied in the context of this study is discussed in the next section.

2.3 AUDIO-VISUAL TECHNOLOGY

Audio-visual technology is assumed to have the potential to expose teachers to unusual and diverse teaching circumstances (Serdyukov, 2017:12). The application of AV technology supports teachers to transform their beliefs, acquire pedagogical content knowledge, and develop pedagogical understanding of students (Koc, 2011:96). The preparation of technology users on how to effectively use technology is contingent (Nelson, 2017:450). This means that the basic skills and attitudes of users with regard to AV technology will determine the use or non-use thereof. This section discusses AV technology, its application in lecture rooms, and how it relates to this study.

2.3.1 What is audio-visual

Chen and Liu (2018:19) indicate that learning is a continuous lifelong process where new knowledge is gained from different sources in life. In the lifelong learning process, technology is a collection of skills, techniques, processes and methods used to provide a service and produce outcomes (Bitner & Bitner, 2002:95). It is also a narrative form of dialogue that is used to communicate or relay information (Whitehead, 2005:960).

Information can be distributed using different methods: playing music, using cell phones, speaking, body language, facial expressions, actions and scenarios. Doughty and Stevens (2002:3) say that in an educational institute, video can be used for a variety of purposes. Video can be defined as a technique and method of delivering information in a form of visuals and motion pictures (Ward III & Macrae, 2004:9). Audio is a term used to

describe any sound or noise that is within the range that the human ear is capable of hearing (Zhang *et al.*, 2017:58). AV technology entails devices that have the capabilities of producing both sound and visual elements (Becker *et al.*, 2017:19).

Different computing systems can be applied to control the delivery of sound, music and visualisations (Weinel *et al.*, 2014:17). In an education context, AV technology means the various equipment types, materials and components for educational purposes (Charles, 2011:26). These include electronic devices such as projectors, films, radio, television, recorders, teaching machines, computers and projectors for individualised and group learning (Haastrup, 2009:282; Salaberry, 2001:41). According to Crowther and Wallace (2019:281), modern lecture rooms should have digitised equipment, streaming media technology, audio and video equipment, filming and narration, music playing capabilities, internet access connectivity and recording functionalities, such as document camera and video camera.

AV technology is a necessity in an institution of higher learning because there are different students and lecturers who learn and teach differently using different methods and styles. For the purpose of this study, AV is defined as the various types of technological equipment used for the teaching and learning process at NWU. These are the devices that possess sound or video, or both. The technology is either available in the lecture room or it is a portable device that can be used for a lesson. NWU has fixed technological equipment (computer, projector, screens, speakers, etc.) and mobile equipment (laptops, projectors, microphones, speakers, etc.) that can be used to achieve the objectives of a teaching lesson. The next section expands on the purpose of AV technology in the context of the study.

2.3.2 The purpose of audio-visual technology

The purpose of AV technology in an institution of higher learning is to create an environment where students actively engage in the learning process (Semarkhanova *et al.*, 2017:180). The use of an appropriate AV technology can elevate educational quality and connect real life situations to learning (Lowther *et al.*, 2008:199; Sadik, 2008:488). The use of AV technology in a lecture room should motivate a student to learn, using different media devices. A variety of techniques can be used to deliver an instruction for learning, such as the use of AV and tactile methods (Goldenberg, 2008:13). There are

many forms of AV technology available for lecturers to use in their lecture rooms (Beeland Jr, 2002:2). In any learning environment, the purpose of AV technology is to offer infinite opportunities in developing the students' logic and physical abilities (Aleksandrov, 2014:252). AV technology can assist to support learning, and is useful in developing the higher-order ability skills of critical thinking, analysis and scientific review (Roschelle *et al*., 2000:88). Stevens (2015:15) believes that critical thinking and reasoning skills are stimulated by the use of AV technology in classrooms.

The new generation of students learn more from the content displayed/presented using AV devices and technology than what they hear from a presenter. This means that the use of AV technology in a classroom improves the student's participation and encourages them to always be present in class so that they can engage and interact with the lecturer and other students. According to Mike Tomei, an independent AV consultant who designs and installs AV systems for classrooms, cited by Stevens (2015:15) AV technology in classrooms play an important role in facilitating and improving active learning environments (Pierce, 2015:26). The use of different technological media provides the opportunities for lecturers to meet the requirements of various learning styles for different students (Bryant & Hunton, 2000:132). The use of relevant AV technology in lecture rooms increases active student engagement during the process of learning (Beeland Jr, 2002:2). Students are motivated when they know that they are going to use the technology to improve their skills and to learn from their peers and lecturers. AV technology in learning and teaching has created a need to change how university students learn using different and more modern, efficient, and effective alternative techniques (Selim, 2007:410).

University students have become more diverse; thus, the need for effective AV technology use in lecture rooms has increased. The effective and efficient use of AV technology in delivering a lecture is based on the skills and expertise, knowledge content and AV technology components used by a lecturer (Beyth-Marom *et al.*, 2003:69). According to Kervin and Derewianka (2011:340), teaching and learning do not depend only on printed materials. They say teaching and learning also depend on resources such as the internet and AV technologies for acquiring and expanding knowledge. AV and other technology equipment play a vital role in the optimisation of knowledge, and the other different sources: sounds, videos, internet, etc. seem to enhance the different stimuli that

are coordinated with the mind (Hershey & Movellan, 2000:814). AV technologies include videos clips, audio clips, sound clips and visual presentations. In addition to that, Cebeci and Tekdal (2006:47) and Motiwalla (2007:582) agree that learning can and should occur anytime and anywhere with access to study materials and video contents using technology. The use of AV technology in classrooms allows both the student and lecturer to interact instantaneously with simplicity and accessibility (McBrien *et al.*, 2009:14). AV technology allows for the flexibilities of lifelong learning at anyplace, anytime and anyhow (Christoffersson & Ioannidou, 2018:3).

The purpose of AV technology is to benefit both the lecturer and the student while enhancing their skills and knowledge. Making use of AV technology can improve the interaction of students, and the possibilities and opportunities to expand their abilities. This study collected data about perceptions and experiences of users making use of the AV technology installed in lecture rooms. Collected data as well as information learnt from literature reviews were used to develop guidelines for the effective use of AV technology and how it can be improved. The next section explains the effective use of AV technology.

2.3.3 Effective use of audio-visual technology

There are different computing systems, some are seen to be more successful than others because of the factors they address in the implementation process (Bingi *et al.*, 1999:12; Lamping *et al.*, 1995:403). Effective use and implementation of AV and ICT in lecture rooms are considered to be powerful tools in the transformation and improvement of the education system (Bottino, 2004:560; Khan *et al.*, 2012:63). Effective use of AV technology aids to improve the young generations' knowledge, skills and abilities by supporting the four fundamental characteristics of learning (Roschelle *et al.*, 2000:79), i.e. active engagement; participation in groups; frequent interaction and feedback; and connections to real-world content.

The presence of technology should be to improve human life in different ways, not to take over their lives. Technology should be flexible for it to be effective to the needs of different users. The use of AV technology as an effective tool for learning is likely to be successful when it is embedded into the different resources of the education system, i.e. lecturer training, student assessment, curriculum and the capacity for the institution to change (Ringstaff & Kelley, 2002:12). The education system must allow for integration of

technology so that lecturers can teach effectively in their classes (Bingimlas, 2009:236). Although some lecturers today realise the importance of integrating technology into the curriculum, some lecturers' efforts are limited by both external (first-order) and internal (second-order) barriers (Hur *et al.*, 2016:106). These barriers have an influence on the factors that impact on the effective use. A student's motivation is influenced by many factors that include but are not limited to lecturer motivation and skills, parental involvement, and effective use of technology (Beeland Jr, 2002:2). Students generally believe that learning is enhanced through the use of audio and visual materials (Evans, 2008:493).

AV technology should benefit all users and students receiving the information presented (Roschelle *et al.*, 2000:78). In addition, AV technology to be regarded as effective, must be used to the extreme and still produce good quality results. The use of multiple media devices provides opportunities for lecturers to meet various student learning styles (Bryant & Hunton, 2000:135). Since this study developed guidelines for the effective use of AV technology in lecture rooms at NWU, the perspectives of lecturers regarding AV technology use in lecturing (collected through interviews) assisted the researcher to determine how AV technology can be improved for better use. Factors impacting upon effective use of AV technology are discussed next.

2.3.4 Factors that impact on the effective use of audio-visual technology

In the past several years, the use of technology in higher institutions of learning has increased (Draude & Brace, 1999:1). This means that technology is used to provide students and lecturers with endless opportunities to change the learning and teaching processes. Ranasinghe and Leisher (2009:1955) and Mathew and Alidmat (2013a:87) both agree that technology will never replace a human being, but can assist to expand their knowledge and expertise. The use of technology improves the inventive and critical thinking skills and the self-concept motivation (Dabbagh, 2007:218). Technology integration can be described as how a lecturer carries out a normal activity reliably and productively (Hennessy *et al.*, 2005:173). Such an activity should reshape and improve student involvement using a technological equipment.

Presenters are often willing to embrace the challenges of integrating technology in teaching to improve student interaction (Buabeng-Andoh, 2012:137). Visual, verbal,

sound and subtitle materials can be used for learning to improve the learner's interaction through productive and receptive skills (Keene, 2006:218). However, Ranasinghe and Leisher (2009:1956) are of the view that a teacher should prepare a lesson that uses technology in a significant and applicable way before integrating technology in class. Harris and Hofer (2011:212) confirm this by saying that technology must assist to support the curriculum, instead of dictating it. The quality of education presented to the students depends on the quality of a lecturer, more than the technology used for presentation (Park & Son, 2009:85). When technology is integrated into a classroom practice, the lecturers' teaching style and vision should be adjusted according to the new developments and changes (Englund *et al.*, 2017:74). A good classroom environment must inspire creativity, cultivate positive interests, attitudes and principles for effective learning for learners and lecturers (Maniruzzaman & Rahman, 2008:122). All the activities and tasks carried out in a classroom must be aimed at building essential skills: independent study and capacity to think for every learner.

Park and Son (2009:87) describe computer technology as a necessary teaching tool used to enhance teaching techniques by promoting a variety of ideas to students. The students' learning experiences are thus expanded in realistic and authentic contexts. Alley and Jansak (2001:10) are of the view that the use of learner-centred teaching principles, practically applying the principle, and thinking creatively by using technological procedures, is the best strategy. When selecting and using AV technologies, lecturers must have a clear understanding and insight of how to produce quality work using the selected resources.

In a classroom, learning and teaching approaches must engage and be appealing to students, and lecturers must ensure that the teaching methods are precise and understood clearly (Prensky, 2001:3). University classrooms that are equipped with high-standard AV technology assist to make the teaching and learning process resourceful and interesting by creating a collaborative learning environment (Clarke *et al.*, 2009:55; Pouezevara & Khan, 2007:30). In order for students to realise their potential and success, lecturers must use their knowledge, teaching methods and teaching strategies that will assist the student to realise their potential (Biggs, 2011:77; Horng *et al.*, 2005:352; Ramsden, 2003:89).

With the introduction of globalisation and an infinite change of information, the new generation has adopted technology as part of their lives (Huda, 2019:174). Lecturers must embrace the ever changing paradigm shift and learn to integrate technology in their classrooms for successful teaching (Hall & Elliott, 2003:302). Students are motivated by the use of familiar technology or communication channels (Hutchison & Reinking, 2010:235). Digital native teaching methods of today are more up-to-date than the traditional methods (Kirschner & De Bruyckere, 2017:137); therefore, devices (iPad, tablets, cell phones, etc.) and applications (Skype, hangouts, etc.) used for social networking are now integrated into classrooms.

Tschannen-Moran and Hoy (2001:783) and Prensky (2008:1005) believe that teachers are the most influential key players in advancing the community and society. However, lack of motivation does hinder the efforts of a teacher and as a consequence the students loose interest. Lecturers and teachers are faced with a challenge of sustaining students through motivation to work hard and succeed (Johnson & Birkeland, 2003:590). The challenges of motivating students become more difficult when teachers resist the change to accommodate different learning styles (Subban, 2006:940). Lecturers also need to be adequately equipped and motivated to implement new technology in their classes (Stronge, 2007:78). Su and Bay (2009:163) have identified these factors that must be modified for the effective implementation of technology in classrooms, i.e. the instructional methods; classroom activities; the content delivery formats; and the role of teachers and students.

AV technology is regarded as a universal commodity that forms an important part of teaching and learning processes and of a community (Baez *et al.*, 2013:146; Bruner, 2009:21). A more effective manner is established between a student and a lecturer when AV technology is implemented to function across any curriculum (Hughes, 2005:281). When the systems are poorly implemented, users become frustrated and they will require suitable training and practice so that they can use the technology effectively (Shortliffe, 2005:1230; Storey *et al.*, 2000:190). Technology is regarded as an additional add-on when it is not integrated into the required curriculum (Hutchison & Reinking, 2011:321). When teachers and lecturers want to move from concrete to abstract thinking, the use of any AV technology can serve as a bridge (Herrington & Oliver, 2000:45; King-Sears *et al.*, 2011:573).

There are various factors that impact the effective use of AV technology in a classroom. Most of the time, one factor may lead to the emergence of multiple factors if not addressed. Research has shown that each factor needs to be addressed for technology to be implemented effectively. In this study, the researcher aims to identify all the factors that impact the effective use of the AV technology in lecture rooms at NWU. The following section identifies the barriers that affect the integration of technology in a classroom and how these barriers relate to the study.

2.3.5 Barriers that affect the integration of technology in classroom

According to Bruce (1999:35) and Koehler and Mishra (2009:62), technology has an impact on all aspects of literacy. AV technology comprises, but is not limited to, programs and applications such as podcasts, social media, video conferencing, blogging, digital whiteboards, online teaching tools, and the worldwide web, that enable the creation, discovery and exploration of new ideas (Sife *et al.*, 2007:58). There are many ways that it can be implemented to address recent learning concerns. One way is for lecturers to use AV technology installed in classrooms (McKnight *et al.*, 2016:195). The use of AV technology can improve and enhance the technological skills and knowledge of a student and the presenter. All involved stakeholders (students, parents, lecturers, administrators, etc.) in a student's educational life, agree that technology is a necessity (Paullet *et al.*, 2010:440). However, there are several reasons (barriers) why educators are not using the technology in classrooms for teaching (Baylor & Ritchie, 2002:396; Laurillard, 2013:59). A barrier is defined as "any condition that makes it challenging or difficult to make development or to accomplish an objective" (Schoepp, 2005:2).

The removal of a barrier enhances the chances of achieving an objective or goal (Ghavifekr *et al.*, 2016:41). The objective of this study is to develop guidelines for the effective use of AV technology in lecture rooms at NWU. However, the study of barriers that affect the integration of AV technology in classrooms is critical because the knowledge can afford guidance for techniques to improve technology integration. Ertmer (1999:52) echoed the feeling that "initiating and sustaining effective technology integration practices is done by teachers with barrier knowledge and effective strategies to overcome the barriers." Students are exposed to various forms of technology at an early stage, but some educators are not integrating technology in their teaching (Bennett & Maton, 2010:321). This situation is complex because it involves addressing the different

barriers associated with the implementation process (Kim & Hannafin, 2011:404; Levin & Wadmany, 2008:234; Rockland *et al.*, 2010:54; Schibeci *et al.*, 2008:315).

The paradigm shifts in learning, changing educational expectations and the diversity of the student population are rapidly changing societies requiring an improvement in teaching techniques (Craig, 2007:159; Duderstadt, 2007:31; Ryan *et al.*, 2004:76). Some educators and lecturers have an interest in using AV technology tools in their classrooms despite numerous barriers (Bradwell, 2010:17; Gosper *et al.*, 2010:251; Mama & Hennessy, 2013:382). There are educators willing to change and accommodate the use of AV technology, even though they are impeded by various factors and barriers (Falvo & Solloway, 2004:60; Lim & Khine, 2006:97; Moeini, 2008:6). Effective adoption of technology into existing environments provides students with knowledge of different subject areas (Putnam & Borko, 2000:7). This increases meaningful learning and professional productivity of a student. Prior studies have identified numerous barriers that affect the integration of technology in classrooms (Ertmer *et al.*, 2006:55). In order to identify the struggles of a teacher and lecturer, it is important for the researcher to look at the AV technology that is available in addition to what they do not have (Yuksel *et al.*, 2009:194).

The next sections discuss general and common barriers that have been identified in previous studies and how they relate to this study. The difference between the two barriers, general and common, is that common barriers are descendants of general barriers.

2.3.5.1 General barriers

A general barrier can be regarded as anything that blocks or hinders the implementation efforts taken (Ertmer *et al.*, 1999:65; Quill, 1995:110). According to Hew and Brush (2007:224), general barriers can be too prevalent to a user. Rogers (2000b:455) also adds that these barriers can be internal or external factors that block the technology user to implement their efforts. The researcher can assume, based on the literature, that these types of barriers are usually experienced by different people from different fields and desciplines. Ertmer (1999:48) and Hew and Brush (2007:240) have categorised barriers into the following two sets, i.e. first-order barriers, and second-order barriers.

First-order barriers concern factors such as environmental readiness (e.g., computers, Internet access), time, and support, resources, and training and teacher knowledge. Al-Alwani (2005:35) calls them extrinsic barriers because they pertain to organisations rather than individuals. Second-order barriers include factors such as teachers' beliefs, attitude, practices and resistance. They are also called intrinsic factors because they hamper technology integration, and can interfere with teachers' technology integration even when first-order barriers have been overcome (Ernest, 1989:254; Ertmer, 1999:48). The effective use of AV technology depends on lecturer motivation, interest, and availability of resources, technical knowledge and students' response towards these audio-visual aids (Mathew & Alidmat, 2013a:87). These are discussed next.

- Lecturer motivation: There are different methods of teaching even for lecturers with the same knowledge and skills, as each possesses different beliefs and personal motivation (O'Connor *et al.*, 2012:248). The presenter must be motivated and have the passion to use the technology in their class (Gilakjani, 2011:106).

- Lecturer interest: Some lecturers are not entirely observant of the numerous AV technologies installed in the classroom (Nitu & Dahiya, 2017:64). This effectively means that these lecturers do not show interest in implementing new technology, and they overlook and do not pay attention to the resources available to them.

- Availability of resources: The 21st generation students consider the availability of resources essential because they are exposed to technology and they are visually vigilant to their surroundings (Rogers, 2000a:414). Parents, educators and government want students to be in schools with modern technology that supplements learning (Granger *et al.*, 2002:485; Reigeluth & Duffy, 2008:46). Technology implementation will remain a barrier as long as there is lack of resource availability in classrooms (Awasthi, 2014:63; Conley, 2010:118).

- Lecturers' technical knowledge: Pedagogy of technology and the content knowledge have been studied to understand the skills and knowledge lecturers' lack. As a result, professional development should be the target to improve the effective use of technology in teaching (Koehler & Mishra, 2009:64). Some lecturers do not use AV technology because they do not have technical knowledge of it and they are still

satisfied with their current approach of teaching, even though they have access to new AV technology (Capper, 2003:61).

- Students' response: When using AV technology resources in class, the awareness, approach and attitude of students determine their interest and feedback with regard to the use of the technology (Gilakjani, 2011:110).

Park and Son (2009:84) identified the following external factors that impact the use of technology in classrooms, i.e. lack of time to learn new technology, and rigid school curricula. They are discussed next.

- Lack of time to learn new technology: Researchers have shown that it takes a lot of time to learn to use some AV technology, and it takes even more time to develop materials that will make use of the technology (Kerski, 2003:129; Nantz & Lundgren, 1998:54; Spotts, 1999:96). The lack of time to develop technological materials is a limitation to the implementation of technology (Brzycki & Dudt, 2005:620; Sumner & Hostetler, 1999:82).

- Rigid school curricula and textbooks that do not allow for integration of new technology: The curriculum needs to be effective so that teachers can use effective tools, techniques, and methods to develop and improve the teaching and learning process for students (Aduwa-Ogiegbaen & Iyamu, 2005:109). According to Conley (2010:200), it is time consuming to integrate technology into a curriculum when it must be aligned with the standards, curriculum and other goals.

2.3.5.2 Common barriers

Technology integration is integral for teaching, meaning that lecturers and support structures must understand the common barriers (Dias, 1999:12). Technology integration causes changes and lecturers need to embrace and prepare for them (Mumtaz, 2000:323). The past decade has seen teachers grappling with technology and different integration models (Selwyn, 2007:85). In this process, some of the common barriers to technology integration were identified. According to Earle (2002:6), barriers are the difficulties and challenges encountered during any process of integrating of technology and teaching. There are a lot of barriers playing a role in the implementation of technology

in lecture rooms and classrooms. Common barriers are experienced by teachers and lecturers because almost every one of them encounter or is affected by them. According to Borg *et al.* (2012:186), these barriers can be caused by internal and/or external factors. In the institutions of learning, these are all the challenges and problems encountered by lecturers when they make use of AV technology installed in the lecture rooms. Kopcha (2012:1119) adds that teachers who do not have mentors and have not done training for using new technology, are more likely to encounter these challenges than their counterparts who have mentors and attended training.

To lay a foundation for this section, a set of common technology integration barriers have been identified by Schoepp (2005:3) from different studies. The barriers have been labelled, measured and rated differently and various researchers (Bariso, 2003:85; Ertmer, 1999:48; Ertmer *et al.*, 1999:65; Hadley & Sheingold, 1993:282; McGill & Hobbs, 2008:194) have identified these similar variations as common barriers: lack of computers, lack of quality software, limited time, technical problems, teacher attitudes towards computers, poor funding, lack of teacher confidence, resistance to change, poor administrative support, lack of computer skills, poor fit with the curriculum, lack of incentives, scheduling difficulties, poor training opportunities, and lack of vision as to how to integrate.

The barriers encountered by teachers are often general, but they hinder the process of integration in the classroom (Bingimlas, 2009:237; Brinkerhoff, 2006:22; Pajo & Wallace, 2007:71). There is an initial fear of failure in using technology in classrooms by teachers, educators and lecturers (Bitner & Bitner, 2002:96). Teachers fear that they cannot use technology in front of their colleagues and students (Bingimlas, 2009:238). Teachers believe it is difficult to use technology and they think they will be laughed at if it does not work (Van Raaij & Schepers, 2008:839; Wachira & Keengwe, 2011:20). Once the technology is found or believed to be difficult to use, users often refuse to use it again because they fear it will waste their time (Wachira & Keengwe, 2011:21).

Teachers and lecturers play an important role in the integration and implementation of technology in classrooms. Mouza (2008:450) and Hutchison and Reinking (2010:231) have identified the following barriers. These barriers include but are not limited to lack of training, scarce resources, limited class time, insufficient access, inadequate technical

support, deficient knowledge and skills, and teachers' attitudes and beliefs. The identified barriers are discussed based on the lecturers' perspectives and past experiences. This means that in order for the lecturer to be able to use the technology, the following barriers have to be addressed individually according to the needs and requirements of different lecturers.

- Lack of training: Not all teachers and lecturers are provided with adequate support that goes beyond learning specific technology skills (Maniruzzaman & Rahman, 2008:122). Using a particular tool and software program does not mean you are the expert in using the technology (Llorens *et al.*, 2002:207). This means that a lecturer can still need training to expand their knowledge. According to Moeini (2008:2), the training of teachers and lecturers includes more than just the pedagogical skills and practical knowledge. Training should cover the areas which the lecturer identifies as weak points and areas of improvement (Henry-Young, 2013:51).

  Every lecturer needs to be given proper training in order to be confident in using the available technology. Lack of training affects the use of technology because the lecturer resorts back to previously tried and tested methods to conduct their lessons. Each lecturer knows their weaknesses and strengths, meaning that training and support will be focused on the areas of improvement and also to enhance their strengths. Adequate training and proper facilitation improve the lecturers' confidence when they present their lesson.

- Limited class time: According to Cuban *et al.* (2001:827), most educators have a problem of limited time given for their classes, which is a common issue that occurs from primary schools through to higher institutions of learning. There are teachers and lecturers that can use technology competently with confidence but they limit the use of technology in class because of limited class time (Frederickson *et al.*, 2005:648; Hanson, 2009:554). Research has shown that teachers do not use technological equipment in class because it takes a lot of time to set up, they have to learn how to use it and it is slow in terms of performance (Dawes, 2001:69; Draper & Brown, 2004:82; Schmid, 2010:169; Sutherland *et al.*, 2004:414).

- Limited understanding: In order for lecturers to be experts on how to use AV technological equipment, they need time to familiarise themselves with the hardware

and software of a range of equipment and applications programs (Buffington, 2004:33; Henry-Young, 2013:62). Limited understanding is one of the major barriers encountered by lecturers. This is mostly exacerbated by the limited time allocated for classes. The limited time for lessons compels some teachers to disregard the use of technology in their classes. It is therefore important for lecturers to familiarise themselves with the technology prior to class and learn to use the technology outside of classroom time. This will save valuable time for teaching and enhance learning outcomes. It may also be important to ensure that the support department provides lecturers with portable equipment and ensures that they are installed in classrooms. This might afford the lecturers more time to familiarise themselves.

- Insufficient access to facilities to use for classes: Access to the necessary facilities for lecturers to integrate technology in their classroom is one of the barriers that decreases motivation and impedes the process (Groff & Mouza, 2008:32; Snoeyink & Ertmer, 2001:88). Lecturers need access to all available AV technology in the class, so as to integrate the technology they believe will improve student engagement and enhance the teaching process (Henry-Young, 2013:56). A lecturer must have access to the available facilities that can assist to improve the methods of teaching and student involvement in their class.

  The accessibility of facilities gives a lecturer confidence in the sense of improving teacher confidence, competence, and attitude. It is important that a lecturer has access to such facilities so that they can explore different teaching styles for different students. This barrier can be controlled by giving lecturers access to all available technology, resources and equipment even if they do not use them in their classes. Support departments can have a test or play class where all facilities can be made available for lecturers to use so that they can learn more about each resource.

- Lack of teacher confidence: The lack of confidence of teachers is caused by a deficiency in the skills and knowledge of the context (Fabry & Higgs, 1997:385; Lawless & Pellegrino, 2007:596). This becomes a factor that influences the integration of technology in class for teaching. Enrolling for a professional development programme improves the necessary skills and knowledge needed (Hollins & Guzman, 2005:551; Wilson & Berne, 1999:174).

Teachers get comfortable in using a technological device when they have knowledge and information of how to use it (Albirini, 2006:375). The difference in experience and expertise between the students and the teacher can have a serious effect on the confidence of a teacher (Helsper & Eynon, 2010:506). The new generation of students is called the “digital natives” because they are exposed to technology from a young age (Bennett & Corrin, 2018:2513). Teachers must be willing to invest their time to use the technology by exploring the functions and advantages so that they can gain confidence for their classes (Keengwe *et al.*, 2008:562; Lam, 2000:391).

It is easy for an individual to lack confidence, and this is also seen in organisations where one works with clients. Teachers must find methods and teaching techniques that they can use in their classes that will boost their confidence in delivering quality to the students. A confident teacher prepares well, is up to date with their work, and challenges their students to do and learn more. These kinds of teachers are always willing to explore other teaching methods and techniques to do things differently and accommodate different students.

- Inadequate technical support: Technical support is a crucial aspect for teachers when they plan to integrate technology successfully in their class (Dias, 1999:13). The users of technology feel at ease and more comfortable when they know that there is support if anything happens (Wood *et al.*, 2005:185). The most meaningful, appreciative and essential support users can be provided with is the technical support for the use of technology in classrooms (Nardi & O'Day, 1999:194). The teachers are depending on the technical support department to assist them when they have to use the various types of technology for teaching and learning (Conley, 2010:106).

  Technology equipment is used constantly; this often results in equipment malfunction or equipment operating below the required standard (Dasanayaka & Sardana, 2011:320). In situations like these, users often have to wait for technical support to diagnose and determine the root cause. Situations such as these often lead to users complaining about the loss of valuable time and the increased chances of the technology not being used again (Henry-Young, 2013:58). When users are faced with a problem of waiting for technicians, others tend to attempt their own repairs by trying to salvage teaching time (Stigler & Hiebert, 2009:138).

This often leads to users making the problem worse and it becomes a barrier to the integration of technology. Frequent technical problems that cause users to wait for hours, days, weeks and months before they are resolved, decreases the possibilities of incorporating technology in classes (Lim & Khine, 2006:98; Skinner, 2016:430). Without continuous and ongoing support, the goal of integrating technology satisfactorily in the classroom will never be achieved (Bailey & Pownell, 1998:47). Many factors can lead to inadequate technical support (Kemppainen *et al.*, 2012:106).

These factors include but are not limited to internet connection, connection to various websites, properly functioning computers, speakers, microphones and projectors, and standardised classroom equipment. The teaching and learning process of delivering a classroom activity is often impeded when the factors are not addressed in time (Bingimlas, 2009:241). The relationship between the user and a technician can be a barrier at times (Dooley, 1999:38). Lack of understanding and a relation between the user and the technician can become a barrier (David & Fahey, 2000:121; Little & Lieberman, 1987:166; Riege, 2005:23). This can happen even if there is sufficient technical support. Integrating technology needs the two stakeholders to have the same understanding and vision.

- Lack of teacher competence: The competence of teachers refers to the capabilities that the teacher has when using technology in the classroom (Sang *et al.*, 2010:110). A lot of teachers are not aware that training is available to them when they need it (Zhao & Bryant, 2006:55). Teachers that know about training have the fear of attending because they think that they will look stupid especially when they ask questions (Argyris, 2000:281). It is a time-consuming task to stay up to date with all the rapidly changing learning tools and applications, but it will improve their competencies and confidence (Penuel, 2006:330).

  Teachers often feel that they are incompetent when they are unsure of their proficiencies when using technology (Banks *et al.*, 2005:242). Some users have a fear that they will embarrass themselves in front of students. The users always want to avoid possible embarrassment by not using the technology at all or not using it beyond the level they know they are capable of (Rosenfeld & Martinez-Pons, 2005:147). Some teachers who do not use technology fear that they will lose their jobs if they do not use

it proficiently (Morgan & Adams, 2009:140; Stadt & Kenneke, 1970:8). They end up using the traditional tried and tested methods. Other teachers are working on expanding their knowledge to enable themselves to use technology that students know for effective teaching and learning (Koole, 2009:26).

The main purpose of teachers familiarising themselves with the circumstances is to increase their technological competencies (Conley, 2010:50). This leads to improved confidence for teachers when integrating technology in the classroom. Research shows that some teachers are not eager to incorporate technology in the classrooms because of various reasons (Dias, 1999:12; Li, 2007:380; Schrum, 1999:85; Sheingold & Hadley, 1990:18). Teachers play an important role in determining to what an extent the technologies are used effectively in a classroom (Ertmer *et al.*, 2012:424). The competence of a teacher plays a significant role in the process of integrating technology in a classroom (Greenhow *et al.*, 2009:249). When the teachers' competencies are not tackled and taken into consideration, they become a barrier when technology has to be integrated.

- Teachers' negative attitudes and beliefs: The guiding factor that determines the decisions teachers make and the actions they perform when incorporating technology in the classroom is the teachers' attitude and beliefs (Chen, 2008:66; Ertmer, 1999:58; Hew & Brush, 2007:229; McGrail, 2005:6; Oncu *et al.*, 2008:23; Sandholtz *et al.*, 1997:103). The attitude of a personnel member affects the effectiveness of technology incorporation (Levin & Wadmany, 2008:237). The negative beliefs, attitudes and resistance to change are regarded as the major barriers for integrating technology in a classroom (Kim, 2002:38). Almekhlafi and Almeqdadi (2010:167) and Ming *et al.* (2010:12) also believe that negative attitudes and beliefs are major impediments that influence other barriers in the integration process.

  According to Ertmer *et al.* (2000:5), Judson (2006:583) and Sang *et al.* (2010:104), the educational philosophies and pedagogy of a teacher in a classroom directly determine the implementation of technology. Hughes (2005:280) believes that the benefits of technology to students will never be understood until the teacher uses the technology in their teaching strategies. Few teachers keep up to date with recent technology developments and changes (Gunter & Reeves, 2017:1306). Some

teachers are unfamiliar with the 21st century technologies available in classrooms for teaching (McKnight *et al.*, 2016:198).

- Teachers' lack of understanding: Effective teaching and learning in a classroom is not controlled by technology, but by changing of dynamics (Bingimlas, 2009:238; Ertmer, 2005:26). The use of technology in classrooms can be restricted by teachers that give a lot of work to students to keep busy (Hew & Brush, 2007:230). Some teachers have the view that traditional methods of teaching knowledge content and skills work for them (Beach, 2012:26; Henry-Young, 2013:60). According to the study conducted by Spires (2008:15), students raised concerns that some teachers did not understand the importance of technology in their lives and beyond the school hours. This concern led to the teachers not taking the time to learn and apply the technology in their classes. Chen (2008:71) also agrees that teachers that understand the importance of technology in their lives, are willing to integrate it more in their classrooms.

  Keengwe *et al.* (2008:562) and Ertmer and Ottenbreit-Leftwich (2010:260) both say that the teacher's attitude can be a barrier in a student's life because it can either improve or impede their participation. A person's behaviour and attitude influence their belief and conclusions towards particular equipment. A student's life is directly or indirectly affected by the attitude and belief of a teacher. The teacher can either have a positive or negative attitude which will lead to the intention to use or not to use the technology in a class. A positive attitude from teachers and students leads to improved involvement and active participation. A negative attitude impacts on the use of technology and implementation in such a way that teachers and students do not want to make an effort of learning through the use of technology.

- Lack of equipment or poorly functioning equipment: The other barrier that contributes significantly to the impediment of technology in classrooms is the lack of equipment available in a classroom (Mills & Ragan, 2000:31). When this barrier is not accurately managed, the chances of incorporating technology in a classroom decrease (Al-Bataineh *et al.*, 2008:386). Any equipment that functions poorly is an obstacle for incorporating technology in a classroom because it is not working properly when needed (Henry-Young, 2013:57).

Wasted learning time, derailed planned lessons, and ineffective lesson execution are all caused by this barrier (Hutchison & Reinking, 2010:231). This leads to demotivated and disillusioned students and lecturers. An institution and organisation must make sure that necessary equipment works to its potential best. Any equipment that works but does not fulfil the needs and actions of the user has a huge impact on the productivity process. The support department must be aware of such equipment that perform poorly and does not work in order to satisfy the client and users. Lecturers cannot afford to have their class time wasted because of poorly functioning equipment and lack of support.

Poor functionality and lack of equipment lead to other barriers (lack of competence, lack of confidence, teachers' negative attitude towards the technological equipment) that impede the integration of technology in classrooms. When users are well trained, there will be less issues of malfunctions and repairs because they will know how to use the equipment (De Vivo *et al.*, 2004:3487). The support department installing the technology in classrooms should be advised to choose the best quality hardware equipment and software possible (Ross *et al.*, 2001:51). A proper upgrade, repair and replacement plan needs to be put in place to overcome the barrier of malfunctioning equipment (Green, 2005:54; Matthews, 2004:71). This will assist keeping up to date with continuous technological changes.

- External barriers from support structures: Factors such as school leadership and administration, school planning, and time-table schedules are regarded as external to the classroom. These factors also impede the incorporation of technology in the classroom for teaching and learning (Rogers, 2000a:416). The importance of technology in a classroom should be seen to be relevant by the heads of departments and support structures (Frost & Durrant, 2003:182). Technology integration has to be emphasised so that funds can be made available for the process to overcome these barriers (Hasselbring *et al.*, 2000:10; Scrimshaw, 2004:9). Technology plays a crucial role in the lives of many in this modern digital native world.

  All involved stakeholders in an institution should make it their priority to make sure that technological devices are updated and upgraded regularly for effective learning. Technology should be incorporated in the process of scheduling timetables in order

to detect any clashes or repetition of classes. This means that it must be implemented to benefit the institution and its stakeholders, students, staff and support structures. Technology utilisation attempts to overcome some of the barriers indicated in Section 2.3.5.

Timetable schedules must be flexible enough to allow teachers and students to focus on more than one subject when there are clashes (Prensky, 2008:1012). Integrating technology can help students who miss classes to revisit the videos and lesson materials of a class (Race, 2005:23). Schedules should allow for students and teachers to move to their next class easier and quicker (Bergmann & Sams, 2012:22). Teachers cannot explore various forms of technology due of the lack of time to prepare beyond the teaching schedule (Mishra & Koehler, 2006:1018). Teachers rather prioritise lesson planning activities and working with students than testing technologies because of limited class time (Chen, 2008:74).

There are a lot of stakeholders involved in the integration of technology into a school curriculum (Adelman & Taylor, 1997:228). All stakeholders have to be involved in the planning and implementation of technology in classrooms (Hale, 2000:9; Sharma *et al*., 2012:348). Poor planning by stakeholders affects teachers and students not to have access to the necessary technological equipment (Fichten *et al*., 2001:215). This then becomes a barrier that must be addressed by external support structures of an institution (Conley, 2010:179). Technology implementation for learning and teaching will be effective when a vision of “how and when” is expressed clearly in a comprehensive plan (Chen & Stroup, 1993:450; Sun, 2000:19).

In summary, many researchers have identified different barriers that affect the integration of technology in classrooms. The literature proves that some barriers are common to the findings of different researchers, but they differ in context. The barriers are stumbling blocks to achieving the goals and objectives. These barriers also develop from the factors that impact on the effective use of audio-visual technology in classrooms. This study aims to gather all the barriers the lecturers experience when they integrate AV technology in their classes.

Data is collected from AV technology users to determine and categorise the barriers identified. Lecturers were given an opportunity to suggest their recommendations on how

and what can be done to overcome the barriers. This was the main focus of the study because the barriers should be addressed by the guidelines. AV technology users indicated their best methods and techniques of using the available technology. The effective implementation and use of AV technology in lecture rooms was critical to the study.

2.4 SUMMARY

The objective of this chapter was to explain the key concepts using the available literature. The overview of the aspects of developing guidelines for effective use of AV technology were explored and explained in a general context and in the context of this study. The next chapter discusses the research methodology and the paradigm followed in this study.

CHAPTER 3: RESEARCH PLAN

3.1. INTRODUCTION

The purpose of the study is to develop guidelines for the effective use of audio-visual (AV) technology in lecture rooms at North-West University (NWU). The purpose of this chapter is to present the philosophical assumptions supporting this research study, as well as to introduce the research approaches and the empirical methods that are appropriate for developing knowledge. Different philosophical assumptions are presented and reviewed; the interpretive paradigm is identified as the framework for this study. The interpretive approach implies a subjective epistemology and the ontological belief that reality is socially constructed (Schwandt, 1994:118).

The chapter is divided into six sections. Section 3.1 is the introduction outlining the layout of the chapter. Section 3.2 introduces and discusses the different research paradigms and motivates the selection of the suitable philosophy used in this study. Section 3.3 expands more on the chosen paradigm by applying it to this study and application of the principles guiding the study is performed. Section 3.4 explains the research methodology and elaborates how grounded theory is applied in this study. Section 3.5 discusses the research plan that includes the selection of participants, data collection and analysis techniques used in this research study. In order to ensure credibility of the research study, rigour was tested and discussed in this section. Lastly, the summary to conclude and outline this chapter is in Section 3.6.

3.2. RESEARCH PARADIGM

The term paradigm originates from the Greek word *paradeigma* that means pattern (Chambers 21st Century Dictionary, 2018). Kuhn (1962:158) was the first to use this word to denote a conceptual framework for examining problems and finding solutions for a scientific community. He then defined a paradigm as an incorporated collection of practical concepts, variables and problems involved, with associated methodological methods and tools. A paradigm is a worldview or a set of assumptions about how things work (Mezirow, 1996:159). It is a shared understanding of reality.

According to Denison (1996:620) and Krauss (2005:758) a paradigm refers to a research culture with a set of beliefs, values, and assumptions that a research community shares

about the nature and conduct of a study. They also say that the nature and conduct of research can range from thought patterns, to actions taken by the researcher or participants. A structure, pattern, and framework or system of scientific and academic ideas, values and assumptions entail a paradigm (Antwi & Hamza, 2015:218; Orlikowski & Baroudi, 1991:2; Schneider & Somers, 2006:352; Swidler, 1986:274). According to Lather (1986:260), research paradigms fundamentally reflect our beliefs about the world we live in and the world we want to live in. Jonassen (1991:6) identified the two common world views as objectivist and constructivist. Guba and Lincoln (1994:106) distinguish between positivist, post-positivist and postmodernist investigations.

An objectivistic world view says that there is an existing objective truth, which is independent from the observer (Vrasidas, 2000:341). This means that the positivism paradigm is rooted in the objectivistic world view—it is based on the belief in an objective reality (Petersen & Gencel, 2013:82). According to Guba and Lincoln (1994:108), knowledge can be gained from data that is experienced and confirmed from independent research subjects. The nature of reality assumed by positivism is realism, whereby an objective reality is assumed to exist (Love *et al.*, 2002:295).

Blaikie (2007:203) describes the constructivist world view as anti-positivist. It is open for subjective construction via subjective interpretation, i.e. it is interpretative in nature. Hatch and Cunliffe (2013:121) describe the interpretivist paradigm as post-positivist. They believe there is a fundamental difference between the focus matter of social (subjective/ interpretive) and natural (objective/realist) sciences. In a constructivist world view knowledge is constructed over time and through experiences, and this leads to various possible interpretations of (social) reality (Nonaka, 2000:6). The constructivist world view has the basic and fundamental assumption that knowledge is (socially) constructed and does not exist independently from the researcher (Vrasidas, 2000:342).

Interpretivists also believe that there are multiple versions of reality (Davis *et al.*, 1993:628; Schwandt, 1994:119). They justify this by saying that, in investigations, knowledge and reality are related to the participant (and participant's perceptions) and these do not exist independently. Constructivism and interpretivism are aimed at interpreting experiences of participants in their original context setting. Interpretivism often addresses essential features of shared meaning and understanding whereas

constructivism extends this concern to knowledge, as produced and interpreted (Gephart, 1999:11).

The third way of investigation, as per Guba and Lincoln (1994:108), is the postmodernist way. According to Leicester (2000:74), postmodernism is regarded as a world view that endorses many perspectives by validating and encouraging a diverse way of thinking from more cultural traditions. It falls within the critical social theory paradigm and is aimed at emancipation, rather than mere understanding or interpreting. (Brookfield & Holst, 2018:339) believes that critical theory is a self-understanding and self-reflecting process that provides criticism of the existing social knowledge and its fundamental ability to change through the realisation of human potential. Critical social theory adopts a more transactional and subjectivist epistemology (Dos Santos & Travassos, 2011:207). These assumptions accept that the researcher and the investigated objects are interactively linked by values that influence the investigation. The aim of critical theory is critique and emancipation of knowledge and reality (Manning & Stage, 2003:20).

According to Healy and Perry (2000:122), a research paradigm has three major dimensions: ontology, epistemology and methodology. They believe that a research paradigm includes interrelated practices and thoughts defining the nature of an enquiry according to these three dimensions. The dimensions are linked to a person's world view, which has a significant influence on the reality of aspects perceived (Bromme *et al.*, 2008:425).

Ontology refers to a dimension of thinking that is concerned with articulating the nature and structure of the world of knowledge (Wand & Weber, 1993:218). This dimension stipulates the nature and form of reality and what can be acknowledged about it. Epistemology refers to the nature of human knowledge and thoughts that can be acquired through different types of analyses and alternative approaches of an investigation (Hirschheim *et al.*, 1995:71). Methodology refers to how the researcher practically goes about to collect and analyse data, that they consider to be required to answer a research question (Antwi & Hamza, 2015:220).

Chua (1986:603), and Gephart (1999:15) classified research paradigms into three philosophically distinct categories based on their respective basic and innate research ontology and epistemology, i.e. positivism (objective realism), interpretivism (subjective

post-positivism or anti-positivism) and critical social theory (postmodernism). These three categories can be used to conveniently situate the research approaches used in the fields of information technology systems. Myers (1997b:241) and Hatch and Cunliffe (2013:11) also say these three philosophical perspectives are the popular paradigms in contemporary social, organisational, and management research. The key features of these three perspectives include the worldview, the nature of knowledge pursued, and the different means by which knowledge is produced and assessed (Morgan, 2007:50; Popadiuk & Choo, 2006:304). However, there is no consensus, as to whether these research paradigms are necessarily opposed or whether they can be seen as contributing to a different role in the same study. The researcher believes the latter.

The following section discusses the three research paradigms classified by Chua (1986:603), and Gephart (1999:15). Design science will also be discussed shortly since it relates to research in the information systems field (Peffers *et al.*, 2007:46).

3.2.1 Positivism

According to Lee (1991:343), the positivist point of view is extracted from the natural sciences. This extraction of knowledge in the natural sciences was done through categorisation of the derived research questions from an existing philosophy; the values of truth, validity and reason assisted to establish positivism. The paradigm is purely focused on gathering facts through observations and experience, and using empirical quantitative methods and analysis (Gelo *et al.*, 2008:268; Saunders *et al.*, 2007:125). Positivism is associated with quantitative research because it is a paradigm that aims to solve everyday problems using statistical analysis by discovering the essential connections (Goulding, 1999:5). He adds that dependable and valid procedures for positivists are used to define, forecast and control the natural behaviours and actions.

According to Myers (1997b:241), positivists are of the opinion that reality is empirically given and can be defined by measurable assets independent of the researcher and the tools. In an effort to increase the prognostic understanding of phenomena, positivists aim to test the theories (Hunt, 2002:75). Information systems research is classified as positivist if the evidence is based on prescribed suggestions, drawing of inferences, measurable variables and hypothesis testing about a phenomenon from the sample to a

stated population (Orlikowski & Baroudi, 1991:5). They say it involves hypothesis testing to obtain unbiased truth, and that it can be used to predict what may happen in the future.

The ontological assumption of positivists is that there is an objective given reality (Avis, 2003:997). This means that knowledge is quantifiable and objective because the reality is independent from the researcher. Johnson and Onwuegbuzie (2004:18) highlight that the truth exists independently from public context, and that applied and designed research can be used to discover the truth. The researcher's hypothetical lens plays an important role in the choice of a method because of the ontological assumptions (Scotland, 2012:9). This means that the primary beliefs of a researcher dictate the method that will be used to conduct a study.

The epistemological assumption of positivists maintains the position that scientific knowledge consists of facts, whereas the premise that the facts are independent from the social constructs, is an ontological assumption (Guba & Lincoln, 1994:109). They believe that researchers do not have any direct or indirect influence on the object of the study. According to Kothari (2004:15), a direct observation is the best and appropriate technique that can be used to discover the knowledge of a phenomenon. Damschroder *et al.* (2009:52) believe that the process of reaching research objectives in the social sciences can be achieved by breaking down the (social) phenomena into small parts that will lead to finding needed facts about them. Positivist researchers tend to view the world through a one-way mirror (Prasad, 2017:33).

According to Healy and Perry (2000:121), the analysis of data does not change because it is observed, but it is rather about how nature determines reality to happen. The use of quantitative methods fits best with deductive approaches, where the theory or hypothesis substantiates the variables, the purpose statement, and the direction of the defined research questions (Tashakkori & Teddlie, 1998:7). According to Creswell (2002:7), hypothesis testing and phrasing research questions determine how the data will be collected and the statistical analysis method that will be used to examine the data. This objective process is used in quantitative studies to project the findings to larger populations (Kothari, 2004:15).

A number of quantitative data collection and assessment methods are deemed to be appropriate and acceptable within this paradigm; they are, for example surveys and

questionnaires, meta-analysis, experimental designs and statistical modelling (Bisman, 2002; Hodge & Steele, 2002; Kirschman & Greenstein, 2002; Perry *et al.*, 1997). Surveys are a flexible research approach used to investigate non-experimental designs, by seeking to assess and describe reality (Mathers *et al.*, 2007:6). They add that questionnaires are often used for collecting data for surveys. Surveys aim to collect data regarding the behaviour and attitudes of the concerned participants (Fenton *et al.*, 2001:85). Meta-analysis refers to the process of locating, selecting, assessing and combining information relevant to a particular research question (Brockwell & Gordon, 2001:826). Statistical modelling refers to representation of a variety of models that are applied to a set of data (Aitkin & Longford, 1986:3). This method examines data and then gives the possibilities regarding the outcome of the study so that the researcher can decide on results that best describe the study (Austin, 2002:105).

3.2.2 Interpretivism

Tuli (2011:99) associates interpretivism with qualitative research. Interpretive researchers start with the assumption that access to reality is only through social constructions such as language, consciousness and shared meanings (Myers, 1997b:241). He continues to say that interpretive studies generally attempt to understand phenomena through the meanings that people assign to them. In interpretive research, the researcher's approach is to involve the people that are studied for the research phenomenon, and determine their perceptions about their realities (Johnson & Onwuegbuzie, 2004:19; Kincheloe & McLaren, 2002:112).

Interpretive research does not predefine dependent and independent variables, but focuses on the full complexity of human sense making as the situation emerges (Kaplan & Maxwell III, 1994:3; Walsham, 1995:76). It can be used to obtain an understanding of the world from an individual perspective. Interpretivists believe that data can be gathered from different participants in more than one way: meaning they are anti-foundationalists (Ponterotto, 2005:126). This also means that data from a participant can potentially be understood and interpreted differently, compared to others; in an interpretive belief system, theories are believed to be existent but they can be interpreted differently based on participants' experiences (Broom, 2005:70). According to Walsham (1993:92), this is

a process where, in the case of information systems research, the information system influences and is influenced by the context of its use.

The ontological assumptions of interpretive research are based on the belief that the world is not objective—instead, it is (subjectively) experienced by individuals (Usher, 1996:13). People's perceptions can change over time and that may affect the social phenomenon being investigated (McArthur & Baron, 1983:216). Interpretivists embrace the understanding that the societal world cannot be understood by simply applying research principles adopted from the natural sciences because the context is different (Moon & Blackman, 2014:1168). Knowledge is developed through ideas obtained by observing and interpreting the social structures (Nonaka, 2000:7). This leads to researchers seeking to create logic of what is happening and why it is happening.

The epistemological assumption of interpretive research is that knowledge and understanding are constructed from experiences (Krauss, 2005:760). This paradigm is subjective—the researcher must understand the world as per the experiences of the affected and involved individuals (Schwandt, 1994:129). He continues by saying the approach aims to also understand the reasons that are behind the social action, instead of only the outcome of the action of said individuals. Interpretive research techniques seek to understand the world according to the view(s) of the involved by consolidating their human perspectives (Kincheloe & McLaren, 2002:98).

The interpretive methods used for research in information system fields aim to produce an understanding of the context of the information system. Interpretivism entails various methods that can be used to collect data within the contextual setting of a study (Tashakkori & Teddlie, 1998:90). identified methods that can be used for data collection and analyses, e.g. interviews, observations, ethnography, case studies, content analysis, grounded theory, document reviews and visually analysing data (Bogdan & Biklen, 1998:25; Glaser & Strauss, 1965:8; Orlikowski & Baroudi, 1991:13; Silverman, 1998:11).

An interview is a method of collecting data through an oral quiz, using a set of pre-planned questions (Robinson-Stuart & Nocon, 1996:438). According to Johnson (2002:105), interviews become very productive when the interviewer pursues specific issues of concern that leads to focussed and constructive suggestions. Lewis (1998:101) believes that ethnography is another qualitative research method, which is extended over a period

of time in a particular community or organisation. Ethnography applies a form of analysis and writing that produces explanations and interpretations about the life of the participants involved, according to the researcher's observations (Denzin, 1997:76). Luo (2011:3) considers a case study as a special form of ethnography. He believes that a case study is conducted in a realistic scenery, with the data collected using transcripts, interviews, notes and observations. Creswell *et al.* (2007:241) and Denzin and Lincoln (2011:443) explain a case study as a qualitative approach that thoroughly explores a bounded system over time, through detailed and in-depth data collection from multiple information sources. The researchers' reflections on the experiences are important data sources in the case study as they can yield useful findings in similar framework (Tracy, 2010:842).

Grounded theory is a qualitative research method that seeks to develop theory that is aground in data that were systematically collected and analysed (Melendez-Torres *et al.*, 2017:111). This means the researcher generates a general explanation of a process, action, or interaction, as shaped by the views of a large number of participants (Creswell *et al.*, 2007:243). In grounded theory, the field of interest is observed first, then the collected data are used for developing the theory (Charmaz, 2008:405). According to Martin and Turner (1986:142), grounded theory is a theory finding procedure that allows the development of theoretical interpretation of common features of a topic by a researcher. Holton (2008:69) also say that grounded theory is a generative method whose purpose is to generate and produce theory.

3.2.3 Critical social theory

According to Myers (1997b:242), critical researchers assume that social reality is historically constituted and that it is produced and reproduced by people. Although people can consciously act to change their social and economic circumstances, critical researchers recognise that their ability to do so is constrained by various forms of social, cultural and political control (Hirschheim & Klein, 1994:94). Critical theory focuses on the hostilities, conflicts and contradictions in contemporary society (Horkheimer, 2002:190). The main task of critical research is seen as being one of social critique, whereby the restrictive and alienating conditions of the status quo are brought to light (Ngwenyama & Lee, 1997:147). The critical paradigm seeks to be emancipatory; it aims to eliminate the abstractions of division and supremacy (Scotland, 2012:10).

The ontological assumption of the critical paradigm is historical pragmatism (Morgan, 2007:57). This view means that reality is formed around, for example, the social, cultural, ethnic, gender and political values. Reality has evolved from a static position to a more flexible and dynamic one, because the world changes every day (Bandura, 2001:12). The interactions between the world aspects, internal influences and the human being, assist to construct and develop realities (Klein, 1959:293). However, this paradigm also holds the view that the aspects and influences have powers that can be used to empower or weaken the creation of knowledge through realities. The process of interpreting and creating knowledge combines effective alternative solutions through understanding of the environment of the study (Zheng *et al.*, 2010:769). A critical researcher has to take actions that will bring a difference in resolving social problems and by evaluating the impact of the suggested actions.

The epistemological assumption of critical social theory is subjective—it is based on real world phenomena and links the common philosophy of the participants (Orlikowski & Baroudi, 1991:18). This means that society has influencing powers in terms of the knowledge that will be constructed from their experiences. Critical researchers believe that knowledge is mediated; knowledge can theoretically be informed and derived from different views of one reality, in order for it to be valuable (Scotland, 2012:11). There are different beliefs in society about how knowledge is constructed and what powers advocate it (Cohen *et al.*, 2013:27). Still, reality cannot be experienced all in one go, but rather through human beings that encounter different experiences daily (Giddens, 1991:23). This means that the knowledge of a person increases with every experience encountered. In the critical paradigm, knowledge is constructed from historical experiences of reality, which can be altered and/or reproduced several times (Myers & Klein, 2011:27). This means that knowledge will be used as it fits the study context within which the researcher is conducting research and adopted for relevance and suitability.

In the critical social theory paradigm, participants and researchers become participants in the process tasks of introducing altered reality, analysing it critically and producing new knowledge (Lather, 1986:268). The conversion process is not carried out by researchers themselves only, but instead, they execute it together with the participants. Creswell (2009:103) affirms this by stating that participants are involved in different processes of the research; collecting data, analysing of information and benefiting from the end results.

Paradigms have different methods that can be used to collect data and, according to Scotland (2012:11), critical social theory techniques include critical discourse analysis (used to examine how social and political dominance is understood through text and talking), critical ethnography (a philosophical positioning that is sensitive to the study of culture), action research (a recurring process of investigating, acting on and evaluating results that will bring practical changes), and ideology critique (a process that reveals the thoughts behind the participants' places of empowerment or disempowerment).

According to Baskerville and Wood-Harper (1996:236), action research is an ideal model of post-positivist research. The action researcher is concerned with studying and creating change (Avison *et al.*, 1999:95). This method orientated towards collaboration for change that involves the researcher and participants (McTaggart, 1991:169). It is an iterative process that capitalises on learning for both the researcher and the participants within the perspective of the participants' background (Baskerville & Myers, 2004:330). Ermakoff (2010:530) believes that critical social theory methods are intended to generate qualitative data, as is the case with interpretivism. The analysis of data also includes interpreting data but critical methods explicitly interpret social norms and values as well (Myers & Klein, 2011:28). For example, in the critical social theory paradigm instructional designers and assessors are encouraged to question and evaluate all cultural assumptions that affect the effectiveness and efficiency of programmes (Osguthorpe & Osguthorpe, 2007:16). This critical theory paradigm aims to review the underlying prospects by searching for reality in order to understand the knowledge within the original setting (Kincheloe & McLaren, 2002:98).

3.2.4 Design science

March and Smith (1995:252) define design science as an endeavour to construct tools that are used to serve a human purpose, as opposed to social and natural sciences that aim to understand a reality. Design science research is a paradigm that has been applied to design artefacts in the information systems field since the 1970s (Avenier, 2010:1237; Cross, 2001:52). This paradigm aims to bring about intended changes by developing technology based solutions and, as such, by extending the boundaries in creating an artefact (Aken, 2004:221). The developed technological artefacts are used by humans and they must have the potential to impact their lives individually or collectively in an

organisation (Orlikowski & Robey, 1991:151). According to Gregor and Hevner (2013:338), designing and evaluating the design science artefact aids to formulate the knowledge of this phenomena.

The process is goal orientated and is more practical, and mostly used in the engineering field—it is concerned with how things can be done (Rolland, 1998:19). However, there is also a different view, i.e. that engineering is not the only field that is change orientated; other fields are also concerned with bringing about change in their own and different ways. For example, according to Simon (1996:56) as cited by Klabbers (2003:489), the logical activity used for producing material artefacts is not fundamentally different from remedies prescribed to sick patients, new sales plans devised for a company or policies created for the social welfare of the state. This means that all fields can bring change in their organisations by developing artefacts that will be used by humans to change their existing (unsatisfactory) situations into preferred ones.

Iivari (1991:251) has classified scientific investigative actions into categories that can be used to achieve change: they can be described as nomothetic, idiographic or constructive. The first category, nomothetic, aims to identify patterns in behaviours across artefacts' designs (Conner *et al.*, 2009:294). It uses data from different designs to determine any relationships across the artefacts. The second category, idiographic, aims to identify any behaviour patterns within a design applied across a number of situations and experiences (Hermans, 1988:793). The last category, constructive, aims to develop designs that do not exist, which will assist to produce new models and frameworks (Burrell & Morgan, 1979:35). The following methods can be used for evaluation: action research, descriptive analysis, analytics, testing, experiments and observation to increase the body of knowledge (Kitchenham *et al.*, 2002:729; Shneiderman & Plaisant, 2006:3; Strang, 2015:51).

The ontological assumption of design science is defined as a formal specification of an explicitly shared concept (Guarino *et al.*, 2009:2). The artefact's constraints and concepts are mandated by this definition to explore underlying assumptions (Panesar-Walawege *et al.*, 2010:337). According to D'Adderio (2011:198), design science assumes the entire world is made up of tangible, hard and absolute structures. They refer to this assumption as realism. The world is assumed to exist independently of an individual's appreciation

thereof, and their social world is as concrete and solid as the natural world (Hudson & Ozanne, 1988:509).

According to Iivari (2007:6), the knowledge base for practically designing artefacts is the epistemological assumption of design science. The epistemology of design science is regarded to be constructive—new prescriptive knowledge is created by designing an artefact (Niehaves, 2007:7). Evaluating the impact of the designed artefact on the users creates new conceptual and descriptive knowledge (Venable *et al.*, 2016:79). The knowledge formulation is concerned about how things are done and the impact it will have on implementation of the artefact (Lubit, 2001:165).

Research methodologies recommend suitable ways to collect and analyse evidence to support or contradict a theorised concept (Ahrens & Chapman, 2006:820). According to Venable (2006:5), research activities in design science are twofold: build and evaluate. Build refers to the construction of the artefact, demonstrating that such an artefact can be constructed (March & Smith, 1995:253). Evaluate refers to the development of criteria and the assessment of artefact performance against those criteria (Järvinen, 2007:48).

Several methods can be used for building and evaluation in design science, to address different problems. Subjective evaluations in field studies are used to construct unique problem solving approaches for developing, for example, decision systems and multi-criteria decision situations (Pries-Heje & Baskerville, 2008:735). They believe these methods are used for evaluating satisfaction with the decision systems used and the intentions to implement the systems. Also, developing prototypes, conducting in-depth interviews, conducting field experiments and modelling systems by using empirical studies and formal proof, are some of the build and evaluation methods that can be used in design science research (Lee *et al.*, 2008:758; Parsons & Wand, 2008:840).

Another method that can be used in design science is action research. Action research is in this context concerned with expanding the typical knowledge as it relates to impact on a social discipline or community (Zhang *et al.*, 2015:152). According to Rapoport (1970:501), action research aims to contribute to practical human concerns in an immediate problem situation. In this case, by developing and introducing an artefact. This is also referred to as a clinical method; the researcher has a helping role towards an organisation or a participant involved in the study (Baumbusch *et al.*, 2008:133).

Researchers bring with their knowledge and theories, while the participants bring their practical and situated knowledge (Cole *et al.*, 2005:327).

According to March and Smith (1995:263), design science research methods are influenced by six characteristics. (*1*) identification and clear description of a relevant organisational information technology (IT) problem, (*2*) demonstration that no adequate solutions exist in the extant IT knowledge-base, (*3*) development and presentation of an innovative IT artefact that addresses the problem, (*4*) rigorous evaluation of the IT artefact allowing the assessment of its effectiveness, (*5*) articulation of the value added to the IT knowledge-base and to practice, and (*6*) explanation of the implications for IT management and practice. The contributions of new artefacts, constructs, methods and models are evaluated with regard to their effectiveness and efficiency to improve the system performance (Segars & Grover, 1998:142).

The next section discusses the paradigms and their suitability for this study. The appropriate paradigm is adapted to suit the needs of this study.

3.2.5 Paradigm appropriate for this study

The four paradigms, positivism, interpretivism, critical social theory and design were discussed and explained based on their epistemological, ontological assumptions and methodological aspects when conducting research. The epistemological and ontological assumptions are used as a criterion to select the paradigm relevant to this study.

The positivism paradigm is not an ideal choice for this study because the study is not objective, and no hypothesis testing will be done. Positivists believe that the truth exists independently from external factors and influences. This paradigm is also associated with a quantitative method of collecting and analysing data; hence is not appropriate for this study. Critical social theory is not applicable to this study because it gains knowledge through an emancipation process where participants express their views. The analysis process of critical social theory includes interpreting data, as in an interpretive study, but the methods used base their interpretations explicitly on the values of data. Design science is not chosen because this study does not aim to design an artefact for the problem. Design science is aimed at developing prototypes and modelling systems in an organisation to solve information technology problems.

The epistemological characteristics and ontological assumptions of a research paradigm are the main factors that determine the choice of a paradigm. This study shares the ontological and epistemological assumptions of the interpretive research paradigm because its stance is relativism and subjectivism: the world must be experienced in order to understand the phenomena studied (Yilmaz, 2013:320). The study aims to understand the perspectives of the participants and develop guidelines for the effective use of AV technology in lecture rooms at NWU. It is in line with the purpose of an interpretive approach in information systems research, which is to report on a context, so as to be understood (Stubbs & Higgins, 2018:490).

According to Deetz (1996:194), research acquires a greater scope when an interpretive approach is used to address impacting and influencing issues. This leads to asking questions such as 'why' and 'how' certain technological routes are created. In an interpretive study, the knowledge of individuals is constructed within the social-cultural context (Mitchell *et al.*, 2000:980). In-depth understanding and knowledge of the phenomena is increased by conducting interpretive research in the contextual setting (Fossey *et al.*, 2002:720). This assists to interpret the meanings participants assign to expressed views because research is conducted in their social setting. It is easier for participants to express their experiences of phenomena when the environment is friendly. Creating such an environment uplifts the relationship between the researcher and the participant because the emphasis is on a socially constructed nature of reality.

These kinds of research environments provide a researcher with an opportunity to observe, investigate, and understand the process (Myers, 1997a:259). This assists to gather and document the participants' experiences through the use of different strategies such as written texts, participant observation, face-to-face or focus-group interviews in a social and cultural context. The views of the participants are used to form and construct the input data needed in an interpretive research study (Lincoln *et al.*, 2011:116). So, in this study, the collected data were used to understand the perceptions and views of participants, in order to develop the guidelines. The study was thus conducted in the interpretive paradigm because of the above presented information. Qualitative data were collected. The next section provides more information on the interpretive research approach applied in this study.

3.3. APPLICATION OF AN INTERPRETIVE RESEARCH APPROACH IN THIS STUDY

The term interpretive research is frequently interchangeably used with term qualitative study, even though these two concepts are different (Cho & Trent, 2006:329; Schofield, 2002:173). According to Arghode (2012:156), qualitative research produces results that are an interpretation by the researcher of the participants' views. Interpretive research is a paradigm that holds the assumption that shared reality is not singular or objective; it is slightly moulded by human experiences in their social settings (Tuli, 2011:100; Usher, 1996:19). Both are applicable in this study. The term interpretive research is frequently used interchangeably with the term qualitative research, even though these two concepts are different (Cho & Trent, 2006:329; Schofield, 2002:173). According to Arghode (2012:156), a qualitative research produces results that are an interpretation by the researcher of the participants' views. Interpretive research is a paradigm that holds the assumption that shared reality is not singular or objective; it is slightly moulded by human experiences in their social settings (Tuli, 2011; Usher, 1996). Both are applicable to this study.

3.3.1 Position of the study

In an interpretive (and qualitative) study such as this one, reality does not exist independently from other relevant factors. For example, the lecturer has to interact with a system (in this case correctly installed AV technology) in order for it to be effective and efficient for their activity of teaching and learning. And, the researcher should not assume that all lecturers are capable of using the available technology properly. Accordingly, for this study, the researcher remains aware that every lecturer has his or her own experiences regarding the use of AV technology. Reality is embedded in the social settings and it is difficult to extract it beyond those settings (Lee, 1991:351; Ormston *et al.*, 2014:12). This means that it is quite a challenge to understand the problems and issues that lecturers are faced with when they are in lecture rooms; hence, it is best to be there so as to observe and experience the issues in its natural setting. The researcher must be involved in the social setting where the installation and/or lecturing takes place to understand the participants' experiences. It is, however, not a practical way to gather

data for this study. Instead, in-depth interviews were applied to collect the relevant data from participants.

The process of interpreting the discovered work theories is done by contextualising the reasons and structures that inform the participants' perspectives that were discovered (Fossey *et al.*, 2002:719). A theoretical framework is an indigenous psychology because it allows a researcher to explore participants' perceptions in the context of their cultural environments and through the lens of their values and beliefs (Black & Mendenhall, 1990:118; Kim *et al.*, 2006:6). In this study, the researcher explored this framework by conducting the study in the lecturers' environment and working space. The AV technology installed in lecture rooms was explored by getting the perspectives and views of the lecturers. These views and perspectives were used to analyse the effectiveness of the system and were guiding factors in the development of guidelines for their effective use. The researcher also aimed to view the participants' narratives against the context which was set out in the literature.

3.3.2 Application of interpretive research principles in this study

Interpretive information systems researchers are encouraged to use a set of principles, for example the one proposed by Klein and Myers (1999:70), for conducting and evaluating interpretive studies. The principles are summarised in Table 3-1 and how they are applied in this study next.

Table 3-1: Principles for conducting and evaluating interpretive research

1. The fundamental principle of the hermeneutic circle	The principle advocates that all human understanding is attained by iteration of the interdependent meaning of parts and considering the whole meaning that the parts form. This principle of human understanding is fundamental to all the other principles.
2. The principle of contextualisation	It requires critical reflection of the social and historical background of the research setting. This is to help the intended audience to see how the current situation under investigation emerged.
3. The principle of interaction between the researcher(s) and the participants	The principle requires critical reflection on how the research data was socially constructed through the interaction between the researcher(s) and participants.
4. The principle of abstraction and generalisation	It requires relating the idiographic details revealed by the data interpretation. This is done by applying principles of the hermeneutic circle and of contextualisation to theoretical, general concepts that describe the nature of human understanding and social action.
5. The principle of dialogical reasoning	The principle requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings with subsequent cycles of revision.
6. The principle of multiple interpretations	It requires sensitivity to possible differences in interpretation among the participants and are typically expressed in multiple narratives or stories of the same sequence of events under study. This is similar to multiple witness accounts even if they all tell it as they saw it.
7. The principle of suspicion	This principle requires sensitivity to possible prejudices and systematic alterations in the narratives collected from the participants

The application and implementation of the identified interpretive research principles appropriate to this study is explained below. The researcher implements each principle accordingly to make sure that the study is conducted thoroughly without any preconception.

- **The fundamental principle of the hermeneutic circle**

The aim of the researcher is to understand the participants' perspectives and views about the existing AV technology in lecture rooms at North-West University. According to Legard *et al.* (2003:141), the participants' opinions and understandings of how they answer the

interview questions give full details regarding the use and effectiveness of the technology. Each individual participant response is used to develop an understanding of the questions asked (Gill *et al.*, 2008:291). These understandings are then interpreted according to each participant's perspectives. The lecturer's perceptions and experience theories are identified and studied further to explore more details of what they mean to them.

Interpretive research bases its philosophies on hermeneutics (Boland Jr, 1986:342). Hermeneutics occurred in the late nineteenth century and is a major part of the interpretive philosophy (Myers, 1997a:240). Hermeneutics can be regarded as an underlying philosophy because it provides the theoretical preparation for interpretive research. It can be used to understand unclear data to make sense or give it a meaning by looking at the detail as well as keeping a holistic view. In this study, it means that the lecturer explains the issues that the researcher aims to understand regarding AV technology related activities in a classroom. This entails providing more details of why certain actions were taken or certain equipment were used instead of others during a lecturing session.

- **The principle of contextualisation**

The main aim of this principle is to gain context, interpretation, and relevance around the effective use of AV technology in the lecture rooms (Blommaert, 2005:48). It is important to understand the context so that the participant's views and clarifications can be understood clearly. In order to gain contextual knowledge from the participants, specific questions should be asked (Turner, 2010:755). This assists the researcher to explore and collect more historical knowledge regarding the context and the participants. The researcher must understand and interpret (contextualise) responses in the context of the research subject, setting and study, through proper interactions (interviews). The lecturers have experiences regarding the AV technology and how they managed to interact with it when they are in class. This is discovered during times when the lecturer encountered problems, how they continued with their teaching sessions and when they did not have problems. Such detailed data and perspectives are collected and interpreted through constant comparison method (CCM) of individual interviews conducted.

- **The principle of interaction between the researchers and the participants**

Romer and Mattern (2004:56) consider that active and passive communications methods can be used to collect data from participants. Active methods include open-ended interviews where follow-up questions can be used to ease the discussions. In active methods, the researcher must ensure that their research subject does not compromise or impact on the quality of the collected data (Mays & Pope, 1995:110). Passive methods include close-ended questions where the participant must answer a yes or no question, or select one answer from a given list and there are no follow-up questions (Legard *et al.*, 2003:143).

For the purpose of this study, individual open-ended and semi-structured interviews were used to collect data from the participants. The researcher also made sure that their prior knowledge on the research topic and interaction with the participants does not influence or guide how questions should be answered. Follow-up questions were asked by the researcher where the participant gave an unclear response on the asked question. The individual interview session assisted the researcher to even observe the emotions vested in the responses of the participants when they responded to the questions. The researcher took note of these expressions as they made the participants' interpretations of the perspectives purer and more understandable.

- **The principle of abstraction and generalisation**

The abstracted data is contextualised within the context of tertiary institutions in South Africa and the rest of the world (Van Schalkwyk, 2007:960). This is where logical connections and common related issues are identified and used to develop guidelines for a broader scope. The theoretical and general concepts of the data interpretation are revealed by applying the first and second principles (Cepeda & Martin, 2005:853). Interpretive research relies more on qualitative data, but quantitative data can be used to add more accuracy and clearer understanding of the interesting phenomenon, i.e. for abstraction/ generalisation. Lecturers gave their experiences and perceptions about the system, but it is also important to combine the data collected from the lecturers in order to determine a common problem or pattern. This is constructed through the use of a quantitative content analysis method of finding how many lecturers struggle with the current systems installed in lecture rooms and how many do not.

- **The principle of dialogical reasoning**

This is where the data is presented as evidence, and is analysed and reviewed. The findings of the research can either support or dispute the theoretical presumptions of the research strategy (Walsham, 2006:322). In the process of developing guidelines, the researcher must be aware of the possible contradictions that may arise between the actual findings from the research subjects and the theoretical concepts from the literature. This should be treated sensitively because it will determine if the findings support or contradict the theoretical preconceptions. The researcher applied this principle by making sure that all the views and expressions of the participants were taken into consideration during the analysis and interpretation process.

- **The principle of multiple interpretations**

Every participant attaches their meaning to an interpretation and it may not be the same as the one of the researcher or another participant (Yardley, 2000:218). For this study, multidimensional includes critiques, conflicting, opposing and supporting ideas and recommendations that can be used to understanding the effective use of AV technology in lecture rooms (Klein & Myers, 1999:77). This understanding is conceptualised from different participants in their different settings and backgrounds. No data must be ignored because it is important to have all the information in order to identify all the possible contradicting or supporting factors and influences (Klein & Myers, 1999:77). The researcher has to find a way of interpreting the multiple concepts from the findings and the theoretical literature.

- **The principle of suspicion**

This principle is applied throughout the study to ensure consistency and no alterations to the data collected from participants (Gasson, 2004:80; Teo *et al.*, 2006:1614). The process of collecting data, interpreting the findings and reporting the results is done by critical thinking. This means that the whole study's processes are contextualised. All the data collected from the subjects requires high sensitivity to make sure that it is not altered or modified by the researcher. These principles add value in terms of rigour to the research study when the researcher adheres to and practises them.

The next section discusses the research methodology in general and the most suitable one for this study.

3.4. RESEARCH METHODOLOGY

The research methodology refers to the general plan of how the researcher goes about answering research questions (Malterud, 2001:484). The research methodology can be thought of as the logic or master plan of a research that throws light on how the study is to be conducted (Saunders *et al.*, 2007:31). It shows how all of the major parts of the research study: the samples or groups, measures, treatments or programs will work together in an attempt to address the research questions (Trochim & Donnelly, 2001:3). Research design is similar to an architectural outline. The research methodology can be seen as actualisation of logic in a set of procedures that optimises the validity of data for a given research problem. According to Scandura and Williams (2000:1249), a research methodology serves as a planning, structuring and executing technique for the research to maximise the validity of findings. This means that it gives directions based on the underlying philosophical assumptions of research design, and data collection. Grounded theory, as the applied method in this study, is discussed next.

3.4.1 Grounded theory

Grounded theory is a qualitative research method that seeks to develop theory that is grounded in systematically collected and analysed data (Charmaz & Belgrave, 2012:351). It is widely used in information system research for phenomenon explanations, process orientated descriptions and context based development (Orlikowski, 1993:310). Regarding this study, the researcher creates a common description of a lecturing process, action, or interactions that is formed by the views of involved lecturers (Creswell *et al.*, 2007:249). At first, the researcher developed interest in the field and observed the situations that happen in the university lecture rooms, as it pertains to appropriate use of properly installed AV technology. This led to the need to investigate and research emergence of an applicable theory pertaining to it. In this case, the emergent theory was incorporated in guidelines for the effective use of installed AV technology in lecture rooms at NWU. So, grounded theory is a guiding framework that is used and adopted in this study to suit this specific research discipline; it is used to develop guidelines for the effective use of AV technology in lecture rooms at NWU. This entails an iterative process

of collecting data to produce and generate knowledge of AV use from the lecturers' experiences.

This method encourages researchers to have an open minded approach instead of conducting the research with preconceived ideas (Williams, 2012:93). The theoretical sensitivity of this study thus asks that the researcher must conduct this inquiry with as few predetermined thoughts as possible. This enables the data collected from lecturers to remain sensitive and original without filtering it through pre-existing knowledge.

According to Carson *et al.* (2001) as cited by Levy (2006:374), a research problem must meet the required characteristics for grounded theory to be relevant. The first is that the research should be interpretivist; the second is that the research should be about complex social processes between people; and lastly, there should be almost no existing theories about the phenomena or existing theories should noticeably be insufficient. This study satisfies the characteristics of grounded theory identified by Carson *et al.* (2001:156).

Firstly, the research is interpretive because it is aimed at collecting data from lecturers who make use of the AV technology installed in the lecture rooms. Lecturers' perceptions and perspectives were interpreted by the researcher to find the effectiveness of the system. Secondly, the research is complex because it focused on different lecturers as users of the AV technology, and support staff thereof. The processes involved include the use and non-use of the AV technology, the reasons why it is used and its effectiveness in the teaching activities for students, and the level of support available when using it. Thirdly, the study was focused and limited to the NWU community, there is no existing study on this phenomenon in this specific context.

Other studies conducted outside the NWU scope were used for literature purposes and for referencing, as it must be noted that, according to Percy *et al.* (2015:78), the researcher may bring their significant experience to an investigation. This means that prior knowledge on the phenomena can be used effectively to contradict or support the developed theories. Edmondson and McManus (2007:1450) also attest to this by adding that the researchers' prior knowledge is useful for formulating the preliminary concept model before moving to the next stage of primary data collection. So, the researcher engaged proactively with the literature of similar studies of AV technology in classrooms and lecture rooms in order to stimulate and identify dimensions that may be used to

examine the effectiveness and efficiency of the AV technology studied. The literature, as a source of data, were therefore also included in the guidelines.

In this study, the researcher examined the different processes involved in trying to understand the patterns and relationships between the lecturer, their teaching and the AV technology installed in lecture rooms. The processes include identifying the causes of use or non-use of the technology, the different contexts in which AV technology are used, the available possibilities of AV technology, the consequences of using and not using the AV technology, and the physical conditions of the technology where it is installed.

The next section discusses the interpretive research plan for the study that includes the selection of participants, and the data collection and analysis methods used in this study.

3.5. INTERPRETIVE RESEARCH PLAN FOR THIS STUDY

The researcher applies grounded theory, positioned in the interpretive paradigm, as the qualitative data collection and analysis method in this study. The research plan is discussed in this section.

3.5.1 Participant selection

According to Morse (2001:63), qualitative research studies' sample sizes depend on five things: the scope of the study, the nature of the topic, the quality of the data, the study design, and the use of observed data. Grounded theory relies on purposeful sampling, which involves recruiting participants with different experiences of the phenomenon, so as to discover the various dimensions of the social study (Palinkas *et al.*, 2015:534).

Purposeful sampling is a non-random technique of sampling where the researcher chooses information-rich cases for the in-depth study (Patton, 2002b:270). The researcher must select a sample from which the most data can be collected in order for purposeful sampling to take place (Merriam, 1998:170). Merriam continues by saying that this strategy pursues situations rich in information that can be studied in greater detail for issues of central importance to the purpose of the research. The number of participants is not predetermined, but rather the researcher can add participants until theoretical data saturation is reached (Sargeant, 2012:1).

Theoretical data saturation means that no new data concepts or theories can be identified and represented (Guest *et al.*, 2006:64). Although it is difficult to predict what sample size saturates a study, some grounded theory studies report that sample sizes can range from 5 to 60 persons (Bozett, 1989; Francis *et al.*, 2010; Lal *et al.*, 2012; Ritchie *et al.*, 2013). According to Ness (2015:1408), data saturation can be any common patterns that appear from countless variations are of particular interest and value in capturing the experience and central, shared dimensions of a setting or phenomenon. He regards these patterns as some of the benefits of purposeful sampling. The participants in this research are the academics employed at NWU.

More details about the participants are provided in Chapter 4. Any individual who uses AV technology in the lecture rooms of the NWU potentially plays a significant role in this study.

3.5.2 Data collection method

The goal of interpretive research is to understand human thought as a social phenomenon (Klein & Myers, 1999:69). Data collection strategies can use a mixture of observation, interviews, and close reading of extant texts (Starks & Brown Trinidad, 2007:1375). During an individual interview, the researcher collected data about the behaviour of participants in their background setting and how the meaning of their experiences are made (Baxter & Jack, 2008:552). In this study, data were collected using interviews.

3.5.2.1 Ontological position of this study

The researcher expected that participants would express different perceptions regarding their existing realities in terms of the following:

- The use of technological equipment in lecture rooms and the interaction thereof as used to construct and explore the reality of teaching and learning.
- Discovering how lecturers make use of the teaching technology on a daily basis in classrooms. All of this is done in the setting where the AV technology is installed.

- Lecturers' experiences determine their existence of reality. The experiences can include varying personal practices, background knowledge, opinions and views and their interpretations of the AV technology.

3.5.2.2 Epistemological position of this study

This refers to the perceptions and experiences of lecturers that determine how reality and theory are created. They were achieved in the context of the following:

- The interpretation of events was done based on the interaction between the lecturer and the AV technology.
- The researcher constructed knowledge by experiencing the natural setting of where AV technology was installed and used.
- The interactive interview process of talking and listening, reading and writing assisted the participant and researcher to be interlocked and understand each other.
- A more personal and interactive process of collecting data was developed as the researcher built relationships with the participants.
- Multiple participants' reality interpretations meant that the researcher had more than one version of the "truth" as explanation regarding the study's objective. All had to be included in the final guidelines.

3.5.2.3 Methodological position of the study

The researcher used interviews and reflective observations to collect data. The researcher also remained aware that the values and ethics of a researcher influences the output and results of this research. Shneiderman and Plaisant (2006:5), Britten (2007:15) and (King, 2004:15) believe that the main advantages of data collection through interviews are that:

- direct contact with the participant often leads to specific, constructive suggestions;

- they are good for obtaining detailed information; and
- few participants are needed to collect rich and detailed data.

Depending on the need and design, interviews can be unstructured, structured, and semi-structured for participants, and may be conducted individually or may be group focused (Myers & Newman, 2007:3). Unstructured interviews have open ended questions and allow the participant to express the views. The interviewer and the interviewee determine the direction of the interview during the session, it is difficult to predetermine it (Hill *et al.*, 1997:536). Short and clearly worded set of predetermined questions are used in structured interviews (Myers & Newman, 2007:4). Structured interviews are good to focus on specific topics and avoid deviations (Morgan, 1993:28).

A semi-structured interview format can work well for different methods of collecting data (Gill *et al.*, 2008:291). Semi-structured interviews have features of both structured and unstructured interviews and therefore use both closed and open-ended questions (Qu & Dumay, 2011:239). As a result, it has the advantage of both methods of interview. In order to be consistent with all participants, the interviewer has a set of pre-planned questions for guidance such that the same areas are covered with each interviewee (Runeson & Höst, 2009:131). Focus group interviews are less structured compared to the three categories of interview discussed. It is difficult to bring structure in a group; however, the possibility of rich data emerging through group interactions may be revealing (Lambert & Loiselle, 2008:230).

For this study, data were collected from the NWU academic staff members in order to assist in the process of developing guidelines for the effective use of AV technology in lecture rooms. The development of semi-structured interviews with the lecturers within their respective campuses was guided by the literature review conducted. Semi-structured interviews were conducted using questions grounded in the literature for use of AV technology in tertiary institutions. The perspectives of different participants from different NWU campuses were represented.

3.5.3 Data analysis method

Data analysis is an interpretive research process of collecting data, organising and analysing it (Thorne, 2000:69). Interpretive data analysis is an iterative, deductive

process of de-contextualising and contextualising (Ayres *et al.*, 2003:872; Morse & Field, 1995:103). De-contextualising occurs when data are separated from the original context of an individual and assigned to a unit code for the meaning in the text (Côté *et al.*, 1993:129). Re-contextualising occurs when the codes are examined for patterns and reintegrated, and organised to categorise the data around the central themes and relationship narratives (Harding & Whitehead, 2013:142). It reframes contextual data in terms of a set resulting categories (Starks & Brown Trinidad, 2007:1375). The trends, patterns and facts are labelled (Fayyad *et al.*, 1996:28). Some researchers believe that it detects thoughts, awareness, learning, planning, understanding and solving problems regarding phenomena (Bradley *et al.*, 2007:1763; Broom, 2005:68; Mansur *et al.*, 1985:166; Miles & Huberman, 1994:75; Patton, 1999:1192).

An entailed form of engagement with the collected data is established, meaning that the researcher's previous experience and knowledge on the effective use of AV technology is curbed so that it does not affect the analysis (Creswell & Miller, 2000:125). This also means that the researcher is objective and unbiased without any preconceptions. The researcher knows that he can encounter situations where he relates to the experiences of the participants but cannot be influenced or influence the data analysis. So, the data are explored with a sense of flexibility and an open mind, creativity, improvisation, planning and adherence to the research rules and steps.

Patton (2002a:264) believes that analysing means transforming data into useful information. This is done by bringing order, structure and meaning to the range of collected data. An analytic process does not follow a linear fashion but it's a spiral-like process that entails reduction of the volume of information, sifting out the important from the irrelevant, identifying patterns and trends, and constructing the framework that communicates the essence of the collected data revealed Nonaka and Toyama (2005:422). Interpretation can be defined as explaining and making sense of the analysed data in order to get to research question(s) answers (Miles & Huberman, 1994:145). In interpretive research, there must be an ongoing engagement process of analysing and interpreting to indicate that the two are intertwined as the researcher can simultaneously interpret and analyse (Boeije, 2002:393). Thus, the combined process of data collection and analysis develops an acceptable and rational interpretation.

3.5.3.1 Coding of data

Creswell (1998:139) describes coding as a systematic process of translating data from an investigative format in which certain statements are analysed and categorised into groups of meaning that represent the phenomenon of interest. Grounded theory as a method of analysis is used to recognise societal phenomena that is not theoretical (Glaser & Strauss, 1965:8). This means that the method is used to uncover the processes that influence the relationships and behaviour of groups. Converting raw data into information is a process of creating theory.

Urquhart (2000:106) labels the three comprehensive types of codes for analysis under grounded theory as descriptive, axial and selective. Firstly, descriptive analysis (examining, comparing, contextualising, and categorising data) forms a valuable initial purpose of analysing text with codes that serve as a semantic unit and clustering them into categories (Miles & Huberman, 1994:58). The axial stage of coding is also referred to as clustering of categories from the descriptive coding (LaRossa, 2005:840). The selective stage of coding is developed from the axial coding using a selective structure that determines the interrelations and the core categories on an abstract level (Corbin & Strauss, 2008:87). The three coding types are further explained and applied to this study in Chapter 4, Section 4.4. Preferably, each interview or observation must be coded before the next is conducted so that new information can be incorporated into succeeding encounters (Gibbs, 2008:105). The initially identified themes can be explored further in follow-up interviews based on the coding of the initial interview (Liamputtong, 2009:134).

3.5.4 Research evaluation: rigour of the study

According to previous research (Charmaz & Belgrave, 2012:347; Morse, 1994:24), the researcher is the main person responsible for the implementation of qualitative research analysis. They also believe that qualitative analysis is inherently subjective because the researcher makes all the judgments about coding, categorising, decontextualising, and re-contextualising the data. Every approach has its own techniques for monitoring, documenting, and evaluating the investigative process and the researcher's role is to assure rigor and trustworthiness (Guba, 1981:78).

In grounded theory, the researcher engages with the analysis as a faithful witness to the accounts in the data (Temple *et al.*, 2006:3). Even as the researchers immerse themselves in the data, s/he must be honest and vigilant about her own perspective, pre-existing thoughts and beliefs, and developing hypotheses. In grounded theory, researchers are involved in the self-reflective process recognising and setting aside their priori knowledge and assumptions of the phenomenon so that it does not affect the results of their study (Gearing, 2004:1436; Sokolowski, 2000:53).

The researcher's investigative goal is to attend to the participants' interpretations with an open mind. In addition, the researcher's reflexive practices assist to examine how the participants' thoughts and ideas evolve as they engage more deeply with the data (Finlay, 2002:532; Glase & Strauss, 1967:364). According to Fassinger (2005:159), researchers document their reactions and thoughts on memos as an audit keeping trail. He believes that researchers keep track of emerging perceptions of the meaning of data, their relations and their understanding of data shapes using initial hypotheses.

3.5.5 Ethical considerations

The researcher adhered to the standard NWU ethical considerations and these have been explained in Chapter 1, Section 1.8.

3.6. SUMMARY

This chapter explained relevant world views and research paradigms and positioned this study. It outlined the research paradigm, research methodology, strategy and approach used in the study. It explained the interpretive research approach used in this study and provided information on the design that includes selection of participants, data collection and analysis methods, and the research evaluation and ethics. The position of the study is presented throughout.

The next chapter presents the study findings. The chapter findings and results are used in the development of a set of guidelines for effective use of AV technology in lecture rooms at NWU.

CHAPTER 4: DATA COLLECTION AND ANALYSIS

4.1 INTRODUCTION

The purpose of the study is to develop guidelines for the effective use of audio-visual (AV) technology in lecture rooms at North-West University (NWU). The purpose of this chapter is to describe the data collection and analysis methods followed in the study, to collect and analyse data. It also discusses the research findings. The findings relate to the research questions that guide the study. Data are used to identify, describe and explore the barriers and challenges lecturers encounter when they use the AV technology at NWU, so as to develop guidelines for effective use. The chapter is divided into eight sections. Section 4.1 is the introduction and it gives a layout of the chapter. Section 4.2 describes the research process method and steps that were followed to collect data from participants.

The empirical process of the study is explained in Section 4.3. The way that the processes of participant selection, data collection and analysis were followed and implemented are indicated. Section 4.4 discusses the coding processes that was followed. The theme generation process is explained in Section 4.5. This section is then expanded in Section 4.6 where the results of themes generation are indicated and showed in tabular format. Section 4.7 discusses the results of the generated themes and integrated recommendations from the participants and literature. Lastly, Section 4.8 of the chapter concludes by summarising all the processes and results covered by the chapter.

4.2 RESEARCH PROCESS METHOD AND STEPS

The interview questions for the study were constructed based on the study conducted by Davis (1989:320). These questions were adapted and modified to address the needs of this study by taking into consideration the perceived usefulness, perceived ease of use and the user acceptance of the AV technology in lecture rooms. The questions were tested with non-participating users to make sure that enough insight is gathered once the interview process starts. Two testing participants were used in this case to address issues that may arise, such as unclear questions and questions that might need follow from the researcher.

The researcher used Atlas.ti™ Version 8 for data analysis as a tool after transcribing the data that were managed, abstracted, categorised and coded. When using the tool, the transcribed data were categorised, assembled into codes and groups in order for themes to be created. The following steps and methods were followed from the beginning of data collection process to analysis.

- Step 1: A lecturer had to voluntarily show interest to participate in the study by completing their details. I then scheduled a meeting with the lecturer in a proposed time slot, as provided by them.

- Step 2: The interview with the lecturer was conducted and recorded. The recording was then sent for transcription.

- Step 3: The transcribed interview data was documented in Microsoft Word. The researcher carefully read the document several times so that the categorisation process can be performed.

- Step 4: The document was then imported into Atlas.ti™ Version 8 for labelling of relevant phrases, concepts, sentences and words to the study. This is an abstraction process that needs the researcher to be unbiased, creative and open-minded.

- Step 5: The abstraction and coding processes were repeatedly executed in order to identify concepts, words, sentences and phrases from the different participants. Data saturation was reached after eight interviews; steps 2 to 4 were repeated until no new data was gathered. The next steps (6 to 8) were then executed.

- Step 6: Similar codes were then combined and categorised together to create groups. The group naming and categorisations were rigorously checked to make sure the relevant codes were represented before creating themes.

- Step 7: The themes that emerged from groups were then categorised.

- Step 8: The last step was to summarise and align the themes with the objectives and research question of the study.

The above steps (1 to 8) were used to guide the researcher in collecting and analysing data from participants during the interview processes. The collected data provided a rich justification of the lecturers' experiences and knowledge of using AV technology in the NWU lecture rooms. According to Delorme and Makeig (2004:9), a data analysis process must first group the data sets before reducing it to address the research question. The process was followed in this study as explained in the above steps 2 to 7. The next section elaborates more on the empirical study of the research.

4.3 EMPIRICAL STUDY

This section discusses the empirical study of the research: participants, data collection, data analysis and developing the themes.

4.3.1 Participants

Qualitative research often focuses on a limited number of participants who have been purposefully selected to participate because you believe they have in-depth knowledge of an issue you know little about, such as:

- They have first-hand experience of the topic of study, e.g. lecturers using AV technology;
- They show variation in how they respond to challenges and situations, e.g. lecturers use the same AV technology differently and for different purposes; and
- They have a particular knowledge or expertise regarding the study, e.g. some lecturers have been teaching for many years and they have adapted to the ever changing AV technology used for teaching.

The researcher had a particular purpose in mind and participants were then identified to be lecturers who make use of the NWU lecture room facilities to conduct their lessons. A random purposeful sampling was used to identify potential participants by distributing an email through a formal University channel. All interested lecturers were allowed to participate voluntarily and the purpose of the study was clearly explained to them before the interview process started. A consent form was signed by each participant before they could partake in the study. Purposeful sampling enables the researcher to recruit potential

participants based on the study objectives, but it also limits the ability to produce findings that represent the population as a whole. A total of eight (8) lecturers, from the three campuses (Vanderbijlpark, Potchefstroom and Mafikeng) of NWU participated in the study.

4.3.2 Data collected

Individual open-ended interviews were conducted with each participant. An individual interview is a conversation between two people; it has a structure and a purpose (Kvale & Brinkmann, 2009:33). It is designed to elicit the interviewee's knowledge or perspective on a topic. Individual interviews, which can include key informant interviews, are useful for exploring an individual's beliefs, values, understandings, feelings, experiences and perspectives of an issue. Individual interviews also allow the researcher to probe a complex issue, learning more about the contextual factors that govern individual experiences. A combination of written responses and voice notes were used for referencing and keeping the recordings for the researcher. The transcripts for the collected data are kept safely in a repository and can be made available upon request.

4.3.3 Data analysis

The main part of the data analysis process entailed the researcher understanding and knowing how to make sense of the collected data. In the analysis process, the researcher identified aspects that were familiar from the participants' experiences and knowledge on the effective use of AV technology, as well as those experiences that differed as each participant described them. Data were transcribed and translated to make sense, the researcher identified expressions, knowledge and experience patterns that alerted him to be aware of conflicting or supporting themes as more data from participants clarified.

According to Berg (2001:182) and Guest *et al.* (2006:62), research questions are not answered by data analysis but rather the answers are found by interpreting the analysed data. The researcher explicated this by making sense of the data collected from participants and transforming it through interpretation into codes, categories and themes. The researcher applied what is referred to as an intertwined process because one interview was conducted then its data was analysed and so on until saturation was

reached. This process was done by using a CCM for comparing the participants' perceptions in trying to conceptualise them to one idea and concept.

Atlas.ti™ Version 8 was used as a data analysis tool to manage the data and systematically sort it (Friese, 2014:113). The input data was collected from the interviews with lecturers and was organised into documents that were used in the data analysis tool. All the transcribed interview documents were imported into Atlas.ti™ Version 8 as a hermeneutic unit named: "How do lecturers use AV technology in lecture rooms effectively for their lessons?" This hermeneutic unit was used as the main data source guide to analyse, by answering the research questions for the study.

The order in which the interviews took place assisted the researcher to assign an identification number to each participant. The numbers ranged from 1 to 8; for example, participant 1 was referred to as P1 and so on, as shown in Figure 4-1.

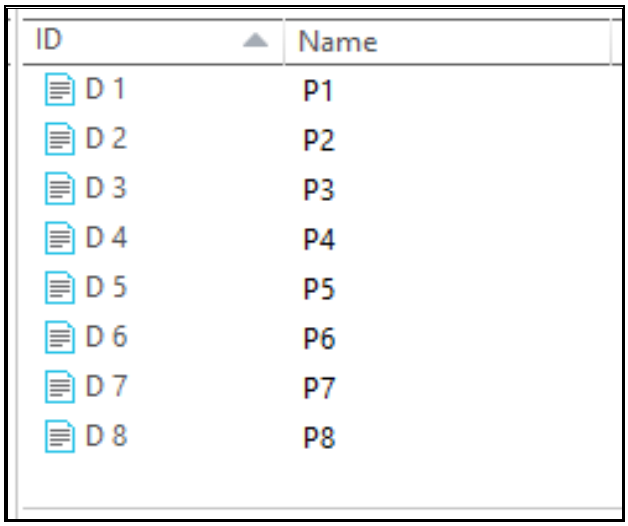

Figure 4-1: Participant identification in Atlas.ti

The next section explains the coding process that was followed and how it was applied in this study.

4.4 CODING PROCESS

For each unit of transcribed participant narrative, the researcher and participant were uniquely identifiable and different from others (Neuman, 2013:181). This enabled a clear representation of data when developing codes and categories in the study. The researcher had to create order out of the diverse patterns and commonalities of

participant experiences and perceptions, by using the process of coding. Hays and Wood (2011:290) and Ghosh (2018:53) described the following coding process stages. The coding steps are explained below and how they are applied in this study.

4.4.1 Open coding

Open coding is the first stage, which required reading and rereading the transcribed data in order to make sense of how the patterns could be identified and recorded. This stage involved naming and explaining the identified patterns or experiences, breaking them down into sections and subsections, comparing them to find differences or similarities and trying to understand the occurrences that are reflected in them (Locke, 2000:64; Ryan & Bernard, 2003:87; Saldaña, 2015:55). The researcher grouped the patterns and occurrences into one colour and named each code according to its focus or concern.

After each code was highlighted, the narrations thereof had a different colour so as to identify the different categories and narratives with different colours. According to Corbin and Strauss (1990:18), this process of representing a phenomenon or idea is called data conceptualising. The researcher applied conceptualisation by comparing the utterances and expressions that are similar to an idea with the same definition and idea. This conceptualising process eliminated the high possibilities of the researcher confusing the different names and ideas. When defining the codes and categories, the names used must be appealing enough to draw the attention of a reader and it should be logically related to the data it represents (Ngulube, 2015:134). This was applied by the researcher in the study by using different colours for codes names and category representations.

4.4.2 Axial coding

The second stage of coding is called axial coding; it involved looking for connections and links between the codes so that all related ideas could be merged into clusters (Kawulich, 2004:99). The process of classifying and looking for category meaning involved searching each category meaning for internal convergence and external divergence (Downing, 2003:834). The researcher integrated this coding process by renaming the codes and categories as data analysis took place. Some codes and categories were merged to best represent the perceptions of the participants. According to Moghaddam (2006:56), the codes and patterns should be consistent whilst distinct from one another so that different participants' similar narratives are easily clustered together.

The other part of the stage was to identify the diverging codes, trends and patterns that were noted from the participants' narratives to the new meanings and understandings of the text that could be taken into consideration. De Vos (2005:338) believes that understanding a new meaning assists the researcher to critically evaluate the patterns that appears apparent by searching for any credible and different explanations of the data. The process of renaming and evaluating the patterns was done constantly by the researcher because the data collected was different and had to be adapted and merged to best represent the views and opinions of each participant.

4.4.3 Selective coding

The final stage of the process is called selective coding; it involved dividing categories for all combined participants' utterances into a selected number. According to Saldaña (2015:57), this process includes examining the data, reducing the data to small and manageable sets that must be written to the final narrative. The process allowed for identification of AV technology as themes and the uses, flexibility, impact, influence as the sub-themes.

The researcher realised that when conducting the three stages, there were blurred artificial boundaries between one type of coding and the next because simultaneous movements occurred between them (Moghaddam, 2006:57). Furthermore, it was noted that these three types of coding stages did not follow a specific sequence but they were rather continuous and diversified. The researcher experienced this during the coding process because coding was not predetermined but instead it was a continuous process that was affected by the data collected. In such cases, the researcher used open coding and had to use selective coding to make sense of the patterns and utterances. The next section discusses the process followed in generating themes.

4.5 GENERATING THEMES

The researcher read through the transcripts carefully in order to gain an overall understanding of each interview process and the participant utterances. According to Rabiee (2004:658), the importance of reading the transcripts carefully assists in getting the sense of each interview as a whole before it can be broken into sections and sub-sections. The data was used to identify recurring patterns or trends that echoed the

participants' expressions, common AV technology and how they use them, the importance of the technology in class and to the AV improvements that can be done in lecture rooms.

Frederickson *et al.* (2005:650) believe that identifying noticeable patterns, and recurring ideas linking participants is one of the most intellectually challenging phases of data analysis. They then add that this phase needs to be integrated with the entire process of analysing data in order to cluster patterns and cohesions that are repeated by participants for themes generation. The researcher did experience challenges when grouping the patterns from each participant. The code and category names kept changing because of the different ideas and thoughts provided by participants. Each participant's transcript was individually analysed, and this caused name changes every time to find a suitable and appropriate representation of the thoughts.

Researchers believe that there is tension between preserving and representing each participants' form of experience and knowledge whilst at the same time developing comprehensive senses, significance and interpretations in the form of general themes common to all the participants (Bybee, 1985:170; Falmagne *et al.*, 2006:72; Scott, 2015:161). This means that research outcomes are not merely a collection of exclusive case history but rather advocate a concept of generalisation that conserves the richly particularised, and socially constituted knowledge of individuals while social interpretations of a particular case are enabled (Falmagne *et al.*, 2006:72). This justified the interpretive paradigm for this study because the interpretation and theme generation processes were guided by this structure.

The researcher realised that generating themes with an awareness of one participant's specification and overview meanings assists in the understanding to make sense of what the other participants say. Graneheim and Lundman (2004:106) believe that producing meaningful compressions that allow the researcher to gain from one participant the understanding that can enhance one's understanding with another participant, is one of the important goals of data analysis. Likewise, Falmagne (2006:170) agrees that theme analysis involves taking note of how one participant's expressions fit the chosen theme while another can indicate a divergence from the theme. The data set used to generate themes was based on the collected data from the participants.

The researcher applied these techniques and guidelines highlighted in previous research in order to generate themes for this study. The following section introduces and briefly explains the identified and developed themes.

4.6 THEME RESULTS

The researcher noted that each individual theme content changed throughout the analysis process in order to adapt to the different participants' opinions while maintaining the codes. Atlas.ti™ Version 8 tool was used to group the data into code sets before reducing them into categories in order to form general themes that represent the view and opinions of the participants.

The reduction process was started by coding the emerging patterns through the use of group categorisation. All the common links and patterns were grouped together after comparing the different codes and categories arranged into groups. After comparing the codes and categories, themes emerged through rigorous steps of summarising and validations of codes and categories. The researcher created the following themes during the data analysis process above:

- Different types of audio-visual technology used by lecturers.
- Lecturer's purpose and usage of the audio-visual technology.
- The lecturer's need for assistance to use the technology.
- Challenges that lecturers encounter when they use the technology.
- The impact audio-visual technology has on the lecturer's teaching experiences.
- Technology flexibility and how it impacts on teaching quality for both the students and lecturer.
- Additional tools used by lecturers when conducting their lessons.
- Technological improvements that can be done in the lecture rooms and the technology used.

Table 4-1 below illustrates the emerged themes and the codes associated with them from the data analysis tool, Atlas.ti™ Version 8. The definitions of the technology equipment and devices mentioned in the table are given in Annexure A.

Table 4-1: Emerged themes with their associated codes

Different types of audio-visual technology used by lecturers	**Number of times code emerged**
Smart whiteboard	4
Clickers	1
Computer / laptop	8
Document camera	7
Microphone	3
Pointers	2
Projector	6
Sound / speakers / music	3
Universal serial bus (USB)	1
Video	6
Lecturer's purpose and usage of the audio-visual technology	**Number of times code emerged**
Stimulate discussion and students' thinking	2
Setting the mood to get students' attention in class	1
Learning and teaching purposes	8
Storage and backup	1
Audibility	4
Communication and interaction	7
Pointing and projection of teaching content	6
The lecturer's need for assistance to use the technology	**Number of times code emerged**
Need assistance every time	1

Needed assistance for the first time	6
Occasionally need assistance	4
Rarely need assistance to use the technology	6
I do not need assistance at all now	4
Attended training / workshop for the use of the technology	8
Had an onsite tour and demonstration on how to use the technology	1
Challenges that lecturers encounter when they use the technology	**Number of times code emerged**
Unreliable WIFI connectivity in other venues	1
Lost time while waiting for support to fix the system	2
Switch between the PC and document camera during class	2
Projector does not switch on when starting the system	1
No challenges except only when hardware or software is not working	5
Lecture room setups are limiting the movement and use of technology	4
The impact audio-visual technology has on the lecturer's teaching experience	**Number of times code emerged**
Adding value and discipline in class	5
Address the needs of younger generation (summaries, visuals, sound)	3
An improved interaction between the students and the lecturer	6
Growth for lecturer creativity and enjoying your work	5
Significant improvement for information accessibility to students	4
Time saving through the use of diverse teaching approaches	4
Improved competitive and constructive competition amongst students	3
Students' participation depends on the students and the different modules	5
Technology flexibility and how it impacts on teaching quality for both the students and lecturer	**Number of times code emerged**
Use of interactive software for teaching	3

Increased vibrancy when using animations	1
Access to information and other resources	3
Improved quality teaching	6
Integration of different tools for better teaching and learning	2
Increased participation since versatile AV technology is used	4
Additional tools used by lecturers when conducting their lessons	**Number of times code emerged**
eFundi	3
Internet	2
J-Pad	1
Lecture capturing	1
Module specific software	3
Skype	1
YouTube	1
Interactive software (Facebook, Twitter, Prezi, etc.)	3
Technological improvements that can be done in the lecture rooms and on the technology used	**Number of times code emerged**
Hardware upgrades	2
Hardware and software maintenance	4
Audio maintenance	1
Additional audio ports	1
Improved communication between support and academics	2
Improved interactive software	1
Give training to optimising current or new AV technology	1
Quicker support availability	2
Availability of microphones	2

Improve the WIFI connectivity in lecture rooms	1
Allowance for virtual connection	1
Install smartboard technology in most venues	1
Install support mechanisms in lecture rooms (help button, telephone, reset button)	2
Install extra screens in large venues	4
Satisfied with the current AV technology	4

Table 4-1 has indicated the developed themes with the codes that contribute to the formation of each specific theme. The number of occurrences for each code is indicated in Column 2 of the table. The next section discusses in detail the themes and associated codes that were identified during the analysis process and gives recommendations for each of the themes shown in Table 4-1 above.

4.7 THEME DISCUSSION

This section is discussing the resulting themes as generated from the data collected from participants. The researcher expands each theme by defining it, quoting a participant and giving a recommendation. The recommendations are based on the literature review and the views and suggestions consolidated from the participants. The seven themes are discussed below.

4.7.1 Different types of audio-visual technology used by lecturers

The purpose of this sub-section is to introduce different types of AV technology used by participants in lecture rooms. Each lecturer identified the AV technology they use in class for teaching purposes. Some lecturers identified the same technological equipment they use in class and this is indicated in Section 4.6, Table 4-1 with the number of times a code occurred.

- Smart whiteboard
- Clickers

- Computer / Laptop
- Document Camera
- Microphone
- Pointers
- Projector
- Sound / Speakers / Music
- Universal Serial Bus (USB)

Lecturers used different AV technology in their classes for learning and teaching. These are tangible equipment installed in the NWU lecture rooms. Salaberry (2001:40) have identified some of the equipment that are regarded as AV technology devices. These devices correspond to the current ones found at NWU lecture rooms as they were mentioned by the participants in the study. According to Table 4-1, the technology used daily are computers and projectors by all participants directly and indirectly for their classes. The document camera is used by 7 of the 8 participants in their classes.

Six (6) out of 8 participants indicated that they make use of sound, audio, music or speakers in their classes for different respective reasons. The other equipment is not used every time by lecturers in their classes as they indicated that they use them occasionally to achieve specific objectives. As already mentioned in the literature, the purpose of technology is to benefit both the lecturer and student by providing information useful to transfer knowledge and teach the content of a specific subject (Goldie, 2016:1066). The identified technology is supposed to assist the lecturer and the students in a learning session rather than giving problems when the time comes to use it.

According to Biggs (2011:128) and Gunter and Reeves (2017:1308), most of the new generation of students want different types of technology equipment in classes used for learning. This means that the students need to visualise and have audio in order for their senses to be stimulated. The study clearly confirmed that different AV technology which lecturers use to conduct their classes can be used to achieve different goals by different lecturers even though it's in the same venue. Other technological equipment, such as a

computer, projector, document camera, speakers are used to achieve the goal for different lecturers in different fields.

Table 4-2, indicates the response of participant one (P1) to the first question asked.

Table 4-2: Participant 1(P1) response

Researcher (R)	**What audio-visual (AV) technology do you use in lecture rooms for teaching?**
Participant (P1)	"eh, eh I use everything there. Basically that media box has access to audio, we play videos or you come with a, maybe you can put a cable on that computer and then you play whatever music you wanted to play. Eh, or a video that you have brought, maybe via a laptop if it is not available online. So I would say what I use for teaching is basically the infrastructure available in the lecture halls"

Recommendation: On this theme and its sub-categories, the researcher suggests that lecturers must check what works better in their current classes and continue with it. At the same time, they should be open to learn about new technological equipment or explore other technological equipment that they believe will enhance and improve teaching and learning in their classes. Lecturers must be willing to learn and enhance their skills and abilities to be up to date with the ever improving technology world. As Hershey and Movellan (2000:814) stated in the literature, lecturers must use technology that optimises and enhances knowledge for themselves and the student. The recommendation is also supported by Beyth-Marom *et al.* (2003:70), when they say that a lecturer has to deliver content in class based on their skills and expertise using AV technology that they are familiar and suitable with.

4.7.2 Lecturer's purpose and usage of the audio-visual technology

This sub-section indicates the different purposes of AV technology that participants mentioned. Participants also indicated the different usages of AV technology in class. The researcher merged these two codes and consolidated them into one theme because they serve a familiar purpose to the lecturer.

- Stimulate discussion and students' thinking
- Setting the mood to get students' attention in class
- Learning and teaching purposes
- Storage and backup
- Audibility
- Communication and interaction
- Pointing and projection of teaching content

The lecturers mentioned the purposes and usage of the technology they use in their classes for teaching and learning. All the lecturers making use of the computer or document camera and projector together said that their purpose is to project the material on their respective devices, for the students to see and understand. Those using the computer, laptop and the projector mentioned that they use slides and other presentation software for their classes. They also stated that they use the technology every time in their classes except when there are tests. The teaching and learning purpose includes making use of Microsoft packages, pointers, videos, eFundi, etc.

Barnes *et al.* (2005:457) believe that collaborative teaching and learning must be prioritised and promoted by lecturers in class. This means that it's the lecturers' responsibility to make sure that they make use of technology that will stimulate the students' thinking in class by means of discussions, interaction and communication. The sub-categories indicated on this theme show that lecturers make use of the available technology to stimulate the students' senses in different ways for them to acquire knowledge. The different students from different faculties and schools need different kinds of technology to give attention to their lecturers in class.

Some lecturers prefer to play music or a video in class before the lesson can start while others do it in the middle of the lesson when students' concentration lapses. The main reason to do this for other lecturers is to stimulate class discussions about the topic or video itself as part of the lesson for that day. Lecturers say that they do not use these techniques every week because they want to be unpredictable to students, but they make

sure that they cover the content every time. Some lecturers prefer to make use of technological equipment such as the microphone in class because they have large classes and they do not have the voice to speak loudly enough and they do not want to shout.

Audibility is very important because a student must hear you clearly so that they can understand what you are talking about rather than be unsure if they heard you or not. According to Ward *et al.* (2006:1554), technology is basically needed to make communicating a lecture more effective without any disruptions and loss of attention. Two (2) of the participants stated that they make use of universal serial bus (USB) for storage and backup of their teaching material when they go to class. The reason for this is to make sure that they can continue with their lecture if there is no internet connection to eFundi or to access videos online.

The response of participant 5 (P5) on the second question asked is indicated below in Table 4-3.

Table 4-3: Participant 5 (P5) response

Researcher (R)	**What do you use the technology for?**
Participant (P5)	"Well, the projector I would use then to present my slides and then brief notes for the students. Because especially in our subject we use a lot of visual material, like photographs. And then the document camera I'd use say if I had to explain something, maybe show them how to do a calculation or so instead of maybe using the blackboard. Or maybe there's a ... What can I think of? Maybe an article, I could also show them as well if I do not have it online, maybe something that I just have nearby."

Recommendation: Based on the theme and sub-categories, the researcher suggests that lecturers find their ideal technology purpose and usage in class so that they do not struggle with their lessons learning to use the technology. This is also confirmed by McBrien *et al.* (2009:2), when they say that the use of AV technology in lecture rooms should allow the interaction between the lecturer and student to be instantaneous, simple

and accessible. Lecturers should learn to make use of the technological equipment in advance before the semester commences so that they know the advantages and disadvantages of an equipment. They must prepare in time if they know the size of their classes to ask for assistance from the support department with regard to the technological equipment they need in class. Improved communication and a good lecture room setup make learning to happen easily and flawlessly; this is also elaborated by Selim (2007:398) and Pierce (2015:25).

4.7.3 Challenges that lecturers encounter when they use the technology

Lecturers encounter different challenges when they want to make use of the AV technology in class. These are some of a few challenges that were mentioned by the participants when they want to integrate technology into their lessons. This sub-section explains the different responses from lecturers, whether they encounter challenges in class or not.

- Unreliable WIFI connectivity in other venues
- Loss of time while waiting for support to fix the system
- Switch between the PC and document camera during class
- Projector does not switch on when starting the system
- No challenges except only when hardware or software is not working
- Lecture room setups are limiting the movement and use of technology

The study has found that most of the participants are able to use the technology installed without any problems. The main issues they encounter are mostly external factors. Al-Alwani (2005:36) calls them extrinsic barriers because they are issues concerning the organisation rather than the lecturers. As indicate above, unreliable WIFI connectivity is one of the problems encountered in the lecture rooms and which hinders the lecturers to make use of the different techniques in class that require the use of internet connectivity. This is a major problem because lecturers need to do online assessments with students in class but due to the connectivity problems they cannot. These lecturers end up

reverting to the traditional methods of using paper for assessments and tasks in class and this adds to other challenges such as time to mark and capture the results.

The setup as categorised in the literature by MacCullagh *et al.* (2017:6), Ertmer (2005:29) and Hew and Brush (2007:240) also forms part of the challenges that lecturers face at the NWU. Most lecturers say that the setup in the venues is challenging and difficult to work with because they cannot make use of the technology effectively and their movement is limited to certain positions. Lecturers mentioned that an issue such as big venues with only one screen in front is a limitation because students at the back cannot see what is projected. Others mentioned that the setup limits them to have easy group work or discussions in class because the venues have fixed tables and chairs, but they still try find a workaround for such situations. The setup of the podiums was also indicated as a challenge because it does not allow for manually switching the projector on or off. The reason behind the challenge is that they experience a problem when switching on the system, as the projector does not always switch on. This means that the lecturer must switch the system off and wait for approximately 2 minutes then switch it on again and they regard this as time wasting.

Proper time management is another essential component of any class (Joyce & Showers, 1980:380; Shulman, 1986:7). This also came up as a challenge lecturers face because they plan their lectures but when they arrive at the venues, technology equipment does not work, and they have to wait for support to come to assist and fix the problem. This leads to more time wasted that the lecturer will have to recover alone so that the students are up to date with the schedule. In certain cases, lecturers are even forced to cancel the class because the problem cannot be fixed immediately. Venues with only one screen give a problem to lecturers when they have to switch between using a document camera and the computer in order to display what they are doing to the students.

Regarding this study, five (5) of the participants believe that they do not encounter major problems in lecture rooms except when there is a hardware or software problem that they cannot solve. They then resort to requesting for support so that they can continue with their class. Some lecturers who do not encounter difficulties in their classes indicated that they are satisfied with the support that they get when there are problems in the venues.

The response of participant 7 (P7) is quoted in Table 4-4 below. The question asked to the participant is also stated in the table.

Table 4-4: Participant 7 (P7) response

Researcher (R)	**How often do you make use of the AV technology?**
Participant (P7)	"For every class that I have I make use of these. And now I've got two modules that I'm offering and the two modules have four double contact periods. So I've got 16 contact periods and then I also have two for each, one and one for supplemental instruction. So in total I add it up to 18 periods, single periods per week, and that I can say 90% of the time I make use of all that equipment. It's automatically part thereof. I almost never go back to the blackboard or the whiteboard anymore. It's really my plan B, C, D, whatever. So that's a constant in my classes and the way that I'm lecturing"

Recommendation: Based on the findings, the researcher suggests that support staff must check that technology is working properly in all venues daily and provide training to lecturers on what they can do when they encounter a problem. Some lecturers are willing to make use of AV technology in their classes but problems such as these external factors do not allow for this. This is what Moeini (2008:3) mentioned in the literature and it is confirmed by participants through the concerns they raised. Properly working AV technology assists in minimising the waiting time and will enhance the abilities and skills of the lecturers for personal growth. Lecturers spend a lot of time preparing for class; hence they would like to have AV technology working at all times to deliver the content to the students. This is an attestation of what Birch and Burnett (2009:122) said regarding the lack of time to learn to use technology in classes because lecturers value their teaching time. Lecturers feel at ease and more comfortable to use the AV technology when they know that technical support is available if they encounter problems in class.

4.7.4 The impact audio-visual technology has on the lecturer's teaching experience

Each lecturer has an opinion regarding their teaching experience and how it has evolved over the years. This sub-section collected data from the participants on how the use of AV technology has impacted on their teaching experience. Some lecturers have used the traditional methods of teaching while others have been using recent technologies in class.

- Adding value and discipline in class
- Address the needs of younger generation (summaries, visuals, sound)
- An improved interaction between the students and the lecturer
- Growth for lecturer creativity and enjoying your work
- Significant improvement for information accessibility to students
- Time saving through the use of diverse teaching approaches
- Improved competitive and constructive competition amongst students
- Students' participation depends on the students and the different modules

According to Mathew and Alidmat (2013b:87), technological developments have a positive impact on a learning environment. This was also seen from the study that the use of AV technology adds value to both the lecturer and the students. Participants mentioned that maintaining a disciplined class benefits the lecturer and students in a process of transferring and acquiring knowledge. The use of technology in class has significantly improved access to information for students in a sense that they can use their devices in class to do assessments and communicate with the lecturer.

The use of technological equipment is addressing student needs that lecturers identify and in trying to use the different teaching techniques to cover the knowledge content. The techniques of addressing the younger generation's needs also save lecturers' time because they make use of technological equipment that have sounds, visuals, etc. to promote the diverse teaching methods and techniques that cater for different students.

When the students see that a lecturer makes an effort to accommodate them, it adds value to their life and how they approach the module (Kirkwood & Price, 2005:258).

An improved interaction between the students and the lecturer is an important factor that shapes the end product for the module (Shabiralyani *et al.*, 2015:228). This is also indicated by the study that when the use of AV increases, interaction in class improves and this leads to personal growth for both the lecturer and the student. Growth increases the chances of a lecturer enjoying their class and the students enjoying what they are being taught according to 6 of the 8 participants. Lecturers also mentioned that there is an improved competitive and constructive competition amongst students when they enjoy the course.

Three (3) of the participants stated that students' participation is not always improved by the use of AV technology, but it depends on the different students from the different faculties and programmes. They said that AV does play a significant role to the students but is not the main influencer for student participation and impacting on their experiences in class.

The response of participant 5 (P5) on the second question asked is indicated below in Table 4-5.

Table 4-5: Participant 4 (P4) response

Researcher (R)	**To what extent did you need help for the first time when you used the technology?**
Participant (P4)	"The help that I would need would be for somebody from IT to come and assist when the screen is off. Because you go there, you find that the multimedia is not on, you switch on, but the screen would not just come on. So normally I would call the office and then they will send somebody, which was really time consuming. But they will come after some time and then they always say that we cannot switch on the screen ourselves. There's no way that we can do it ourselves, they have to be there to switch it on for us. So that was a bit frustrating. Because there was a time when I asked this guy, why can't you let us be able to switch on this? Because they would go somewhere to the back and they will go and press something at the back and then the screen will go on. So if there was a way for us to be able to do everything, it would be really helpful and timesaving. But I did need some help initially, not to use the material but to have access to them."

Recommendation: On this basis, the suggestion is that lecturers find different techniques that can accommodate different students in order to have impact on them and their experiences in lectures. This can be done by using the tested methods and exploring new ones that they think will have an impact because the new generation of students' concentration lapses quickly when you do the same thing every time. The recommendation agrees with Jeppesen *et al.* (2017:113) and Stevens (2015:33) that students would appreciate modern, efficient and effective use of AV technology that stimulates their thinking and reasoning. This recommendation is also supported by Hughes (2005:281) when saying that lecturers need to use the AV technology outside the classroom for them to understand the benefits it has for students.

4.7.5 Technology flexibility and how it impacts on teaching quality for both the students and lecturer

Every AV technology equipment possesses certain qualities and advantages when used effectively and efficiently. These qualities enable the technology to have the flexibility to be used by different lecturers for different purposes while still producing the best results. The sub-section explains the technology qualities and their flexibilities as identified by the participants.

- Use of interactive software for teaching
- Increased vibrancy when using animations
- Access to information and other resources
- Improved quality teaching
- Integration of different tools for better teaching and learning
- Increased participation since versatile AV technology is used

According to Kirkwood and Price (2005:261), flexibility is achievable through the use of multiple media that will provide students with a richer perspective. This is confirmed by 6 of the 8 participants when they said that the use of AV technology had improved the teaching quality in their classes. The same number of lecturers said that they were satisfied with the flexibility of the technology in lecture rooms at that moment even though they believed there was still room for improvement. They could do what they wanted to do whenever they wanted to do it without requesting for support or experiencing any problems; hence they believed the installed technology was serving its purpose and was doing it effectively.

Lecturers believed that the use of versatile technology equipment had assisted a lot in improving the students' participation and having access to information and other resources. Choosing a variety of tools supports better flexibility of an open-ended activity than that of a single integrated system (Glazer *et al.*, 2005:58). This study showed that the lecturers made use of the different tools to do activities and this had seen an increased vibrancy from the students. Lecturers made use of interactive software that captured the

students' attention in class and it was easier for them to concentrate and remember what the lecturer was talking about. The students' senses were explored and broadened to try and remember easily with the use of animations and different AV tools installed in lecture rooms.

Table 4-6 below represents the response of participant 2 (P2) to one of the questions that was asked.

Table 4-6: Participant 2 (P2) response

Researcher (R)	**To what extent does the flexibility of AV technology allow you to do what you want to do in your class?**
Participant (P2)	"What I want to do in my class, all the lecture halls are equipped. Because we also have ... There are some that do not have document cameras, but we have some document cameras in our subject group, so then you just take one along. So what I need is the computer for using certain software and the document camera for doing presentations, illustrations, explanations. So the way in which I teach, I feel the lecture halls are appropriate. Of course I enjoy when I have a lecture hall that I do not have to carry the camera with, but I can understand one can't, it won't have all the lecture halls equipped with document cameras and that ... But at this stage there are a fairly large number of the lecture halls are equipped with document cameras at this stage."

Recommendation: For this theme and its sub-categories, the researcher believes that lecturers should continue using the technology. According to some of the lecturers' perspectives, student participation and teaching qualities have improved significantly since they started making use of the AV technology. Lecturers must try to learn new features of the current technology or how to use new ones to enhance the students' performance and participation by working together with the support department. It is shown in the literature that a lecturer's attitude affects and has impact on the incorporation of technology in a class. The ever changing student population and dynamics play a significant role in the effective use of AV technology in class. Henry-Young (2013:51)

agrees with the recommendation; lecturers are making use of the AV technology in lecture rooms because it improves student participation and results output.

4.7.6 Additional tools used by lecturers when conducting their lessons

There are different tools and software available to use for conducting lessons. The additional tools play a significant role in the educational sector because some lecturers prefer to make use of the tried and tested tools while others are willing to explore and learn to use new ones. Participants of this study have stated some of the additional tools they use in their classes for teaching purposes:

- eFundi
- Internet
- J-Pad
- Lecture capturing
- Module specific software
- Skype
- YouTube
- Videos
- Interactive software (Facebook, Twitter, Prezi, etc.)

Six (6) of the 8 participants mentioned videos as one of the forms of tools they use in class and they use it for different reasons. Video has been categorised as an additional tool because it is not a tangible equipment that still needs user interaction for it to work (Gee, 2003:3). All these additional tools except module specific software and J-Pad need the computer or laptop to be connected to the internet for a lecturer to access them. The challenge of unreliable WIFI connectivity in venues obstructs lecturers to make use of the tools. eFundi is used by 4 of the participants in class to access the resources and information they need. Three (3) of the 8 participants make use of the module specific software in their classes.

Internet is the main feature that makes it possible for these tools to connect; hence, the support department should make sure that all venues are WIFI connected. There are many alternative teaching tools that can be implemented that are outside the scope of this study (Estai & Bunt, 2016:156; Fitzpatrick *et al.*, 2004:18).

Table 4-7 indicates the response of participant 6 (P6) to the quality of teaching question that was asked.

Table 4-7: Participant 6 (P6) response

Researcher (R)	**How does the use of AV technology affect the quality of the work you teach?**
Participant (P6)	"I think it support it very strongly because in a way you have a guest lecturer. If I use a video, in a way you have a guest lecturer, a very well-known one and well-respect, but I think especially nowadays with short videos, but that's very much in ten minutes you can get a good idea of the message. So for me that's definitely linking the students with the top names in the industry. And once again, using it as a bit of a teaser if I can put it that way to get the thinking going. That's good for me. Either different from the presenter or supporting, but it opens up nice topics for discussion. So sometimes I'll want the students to differ. So it's nice to use that as well. So it's once again a way of getting the thinking going. That's my main purpose with using something like that. And it depends on if ... In the beginning of the masters' programme I'll use a bit more structure in terms of slides because there's some knowledge I want to convey to the students as well. And then later on it's more application. So my first contact or two will be a bit more media use and then later on it will be much less."

Recommendation: The suggestion is that WIFI connectivity in all NWU lecture rooms be available to both students and lecturers so that they can make use of these tools that improve the teaching and learning methods. According to the response of the participant

and Khan *et al.* (2012:64), the supporting departments and external elements play an important role in making sure that the quality of teaching is optimised. Students believe that learning can be enhanced through the use of AV technology as when lecturers use various learning styles supported by AV technology as stated by Bryant and Hunton (2000:141). The external support structures of the NWU need to take this recommendation into consideration because this is one of the barriers that are beyond the lecturer when they want to integrate the use of technology in class.

4.7.7 Technological improvements that can be done in the lecture rooms and on the technology used

For any problems and challenges, there are always suggestions and recommendations that can be considered to improve the situation. Participants have indicated their concerns and problems regarding the use of AV technology in lecture rooms. They also provided some suggestions and improvements that can be considered to attend to their problems and make them happy:

- Hardware upgrades
- Hardware and software maintenance
- Audio maintenance
- Additional audio ports
- Improved communication between support and academics
- Improved interactive software
- Give training to optimising current or new technology
- Quicker support availability
- Availability of microphones
- Improve the WIFI connectivity in lecture rooms
- Allowance for virtual connection
- Install smartboard technology in most venues
- Install support mechanisms in lecture rooms (telephone, reset button)

- Install extra screens in large venues
- Satisfied with the current technology equipment

According to Lage *et al.* (2000:32), most lecturers are more comfortable when working in a collaborative than in a competitive environment that is more demanding and stressful in terms of using technology. In this study, most lecturers are more comfortable using lecture rooms in which the technology is installed rather than lecture rooms in which it is not yet installed. These lecturers have also made suggestions on what can be improved in order for them to use the technology effectively. Four (4) of the 8 participants say that they are satisfied with the technology installed in the NWU lecture rooms because they are able to present to their classes without any issues except when there is a major problem that is beyond their control. These suggestions are expanded to guidelines in Chapter 5 as part of conclusions and recommendations.

Table 4-8 shows the response of participant 8 (P8) to the suggestions and improvements question that was asked. This question gave participants an opportunity to raise their opinions and views on how they would like the AV technology in lecture rooms to be structured and installed.

Table 4-8: Participant 8 (P8) response

Researcher (R)	**What do you think can be done to improve the current AV technology in lecture rooms?**
Participant (P8)	Participant 8 indicated that some of the AV technology installed in the venues was outdated meanwhile technology was always improving and changing "*I think some of the stuff is a bit old, but I mean, technology change every two weeks so one must not get stuck on that.*" The participant also mentioned that support was too far from the venues. The suggestion was made to have someone nearby or onsite to save travelling time for support. The participant mentioned problems encountered in lecture rooms such as bad lighting, shaking projectors, and suggested "…. *let's call it preventative maintenance.*"

	The participant also raised concerns with support for part time classes when you did not know what to do and who to call, "*Sometimes we get stuck in a part-time class, but luckily it's small, so you can show them or you can sit around the tables and show them stuff*." The participant said that IT support was not always available when you needed it and the technology was not always working. "..*you've pushed all the buttons and you reset and you start.*"

Recommendation: Based on the theme and its sub-categories, the suggestion is that lecturers and support department improve communication between them as it is the key to resolve most of the problems encountered in lecture rooms. As Conley (2010:106) stated, lecturers were depending on the technical support department to make sure that the AV technology in lecture rooms functioned properly and that there were various technological devices available for use. The process of continuous and ongoing support was built upon the good relationship between the academic and support staff at an institution. Dooley (1999:37) also mentioned that poor relationship and lack of communication between the support staff and lecturer became a barrier even if the support structure was in place. These two structures needed to have the same understanding of what was expected from each other so that they could have the same objective regarding the use of lecture rooms.

4.8 SUMMARY

The chapter discussed the research paradigm applied, method and steps used, empirical process and interpretation of results with reference to the literature reviewed. The discussion of results is based on the collected data and the purpose of the study. Lecturers stated their experience, identified challenges they face when they want to make use of the AV technology and they also gave some suggestions on how their problems could be resolved. Recommendations were added to the identified problems and challenges gathered from lecturers' experiences. In the next chapter, the study concludes by discussing the reflections, limitations, conclusions and recommendations for developing guidelines for the effective use of AV technology at NWU lecture rooms.

CHAPTER 5: CONCLUSIONS, REFLECTIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The purpose of the study was to develop guidelines for the effective use of audio-visual (AV) technology in lecture rooms at North-West University (NWU). This final chapter gives an overview of the study; it includes the purpose, objectives, research methodology, findings and recommendations, and possible future research. The researcher identified a gap between use and *effective* use of AV technology by lecturers at NWU. This encouraged the researcher to investigate this phenomenon in order to see the causes and challenges that lecturers face when they use the technology. So, the study focused on the following research objective:

Develop guidelines for the effective use of AV technology at NWU.

The need to investigate lecturers' experiences and perceptions on the effective use of AV technology in class is the fundamental driver of this research and providing the results from the lecturers and literature reviews is regarded as the outcome of the study. In order to address the primary objective, as per Chapter 1 Section 1.4.1 of the study, the secondary objectives, which include theoretical and empirical objectives, were achieved.

This chapter is divided into seven sections. Section 5.1 is the introduction and gives a layout of the structure of the chapter. Section 5.2 summarises the research findings of the study. Section 5.3 introduces and explains a set of proposed guidelines developed for the study. Section 5.4 gives the summary of the research study in general and how it was conducted. Section 5.5 contains the reflections on the study, which include the literature review, methodology, interpretive research principles, study contributions, study limitations and ethical considerations. Recommendations for future research and conclusion of the chapter are provided in Section 5.6 and Section 5.7 respectively.

An overview of the study from the conceptualisation to the results of data analysis is provided in the next section.

5.2 RESEARCH FINDINGS SUMMARY

After the analysis of the collected data, the following themes emerged, that were applied to develop the following guidelines for lecturers for the effective use of AV technology in lecture rooms at NWU. It must be noted that some of these guidelines include suggestions for support staff; it is because technology can only be effective if effectively installed and maintained by support staff. All the guidelines, however, reflect the views of lecturers on what can/should be done so that they can optimally use the technology:

- *Different types of audio-visual technology used by lecturers*. Lecturers need to know the type of AV technology they need in their class and the ones that will advance their teaching strategies to improve student learning. They should be willing to explore new technology that they can use in their class for future purposes.

- *Lecturer's purpose and usage of the audio-visual technology*. Any technological equipment that a lecturer decides to use in their class should serve the purpose and should be effective when it is used. The lecturer must know what to do to make the technology serve its purpose. Lecturers must use technology that will improve learning and increase student participation while making sure that they cover the content in the curriculum.

- *The lecturer's need for assistance to use the technology*. The support staff should make assistance available to lecturers as quickly as possible when needed to save teaching time. Lecturers should be given training to minimise the need for regular assistance in a venue. A lecturer must identify a lecture room that they always require assistance at and inform the support staff so that they can discover the root cause of the problem.

- *Challenges that lecturers encounter when they use the technology*. A lecturer must not struggle when they need assistance. There should be a process to follow if the technology is not working or the lecturer encounters challenges in class. Support staff should try to solve the challenges in any way possible for teaching to take place. A lecturer that encounters a technological challenge when teaching, is not a happy client, so support must try to keep their clients happy. Support staff must

make sure that the technology is available and usable to lecturers in the lecture rooms.

- *The impact audio-visual technology has on the lecturer's teaching experiences*. The lecturer must be willing to advance their teaching capabilities by learning to use AV technology that improves their experiences and skills. The technological equipment they use should have an improved impact on the student interaction and progression.

- *Technology flexibility and how it impacts on teaching quality for both the students and lecturer.* The support staff should make sure that the technology installed in the venues allows for flexibility to accommodate different lecturers. If there is flexibility, all lecturers will be able to deliver quality teaching and content knowledge to the students.

- *Additional tools used by lecturers when conducting their less*ons. The support staff must check for additional tools that lecturers use in their classroom for teaching so that they can find techniques and methods of integrating them in the venues. They must try to make sure that the tools are available in order to allow lecturer flexibility and implementation, e.g. internet connection for YouTube and eFundi to work.

- *Technological improvements that can be done in the lecture rooms and the technology used*. Support staff should take the suggested improvements into consideration and plan to implement those that are possible as soon as they can. This will motivate lecturers to use the technology effectively, but upgrades must be planned thoroughly, and lecturers must be notified where possible.

5.3 SET OF GUIDELINES

The process of developing guidelines was guided by Thomson *et al.* (1995:237) chain of events to produce effective guidelines. The research conducted research on the published related to the study. Guidelines were developed using the published knowledge and the data gathered from the participants of the study. For the purpose of the study, the dissemination process means that the researcher tests and reviews guidelines before they can be sent out to all the lecturers at NWU. The implementation and evaluation

processes will be done once all involved NWU stakeholders are consulted and have given approval. These guidelines are developed for lecturers only, meaning that lecturers are the main role players in the evaluation and review processes. This means that the researchers' guidelines are measured against the role players and the key principles as set out in Section 2.2.5.

The development of guidelines for this study adhered to the key principles because the main standards, consistency and acceptability are indicated in the development process. The researcher indicates how each principle was met and implemented using the data collected from the lecturers and the literature.

Principle one: guideline should be outcome based. The researcher used the findings and perspectives of the lecturers on AV technology to assess possible alternative recommendations. The research objective of the study guided the researcher in making sure that the outcome based principle is met and satisfied. This principle was revisited throughout the development process to make sure that the objectives are met.

Principle two: guideline should be based on the best available evidence. The relevant source of information that provides evidence for this study are the conducted interviews that were used to collect the data. Lecturers experiences and theoretical data played a significant role in the development of guidelines and recommendations on how the AV technology in lecture rooms can be enhanced for better use.

Principle three: The method used to synthesise the available evidence should be applicable and relevant. The researcher included all the available information when developing guidelines considering the different views and opinions of the lecturers. There were supporting and contradicting opinions from the lecturers and the researcher found out that there are no explicit methods to develop guidelines but rather all views must be taken into consideration.

Principle four: The guideline development process should combine several disciplines and include consumers early in the development process. The researcher conducted the interviews with the lecturers, whom are the intended users of the developed guidelines. All the guidelines were based on the views and expressions made by the lecturers at

NWU. The other stakeholders' views, perspectives and opinions are not included in the study due to the limitations concerned.

Principle five: Guidelines should be flexible and adaptable to changing developments. The developed guidelines are flexible, to be implemented at any campus of the NWU considering the different demographics and resources. These guidelines are based on the data collected from the three campuses, hence they can be adapted and modified to suit each campus needs. These guidelines can even be used by lecturers outside the NWU if they are adapted to meet the needs the specific institution.

Principle six: Guidelines should be developed considering resource constraints and implications. All the guidelines were developed in consideration of the different constraints and implications that each campus has. This means that for each campus, there are financial implications involved when you have to buy new equipment or upgrade. Some of the recommendations include additional equipment installed in lecture rooms, constraints such as space where equipment can be installed were taken into consideration. Involvement of other stakeholders (IT, Maintenance departments) is regarded as a constraint because they need to be included in the planning phase.

Principle seven: Guidelines must be developed, disseminated and implemented taking into account their target audiences. In this study, the target audience are the lecturers and they were involved in the development process from the beginning. The other stakeholders will have to be consulted to address the what, where and how process of disseminating and implementing guidelines. This principle goes hand in hand with principle four, involving several disciples or stakeholders. For the purpose of the study, the target audience views were represented even though not all involved stakeholders of the NWU were part of the study.

Principle eight: The implementation and outcome of the guidelines should be evaluated. This principle is to be checked and tested once the implantation of the guidelines is approved and accepted by all involved NWU stakeholders. For the purpose of this study, the researcher continuously evaluated the recommendations and perspectives of the lecturers to make sense of what they need.

Principle nine: Guidelines should be updated regularly. Once all the involved NWU stakeholders approve and accepts the proposed guidelines, they will be implemented and updated regularly to accommodate the ever changing AV technology infrastructure in lecture rooms. This principle is applied as the improvements and enhancements that can be made to the current setup in lecture rooms for lecturer to effectively use the installed equipment. This assists to improve and update the guidelines as other researchers may come with other ideas and information.

A set of guidelines developed from the emerged themes are presented for the study. The primary objective of the study was to develop guidelines for effective use of AV technology in lecture rooms at NWU. These guidelines were developed through the exploration of lecturers' perspectives and experiences of using the AV technology installed in the lecture rooms. The developed guidelines focus on the technology used, knowledge required and challenges of using the installed technology. Guidelines have been categorised into four groups: technology equipment, lecturers' skills, challenges and upgrades of AV technology in lecture rooms.

5.3.1 First proposed guideline: Technology equipment

The data analysis process indicated that various kinds of equipment are regarded as AV technology. A lecturer can use any technology that has a benefit for their class and may decide not to use other equipment they do not need. The researcher proposes that each lecturer must know what works best for them and their students. The support staff must make sure that the technology installed in the venues is working to meet the needs of the lecturer and NWU: providing the best education with the best tools to the students. Support staff need to do a needs analysis to determine which technological equipment lecturers use daily, which equipment lecturers would like to be installed in which venues and how lecturers would like the installation to be done so that they can use the technology.

5.3.2 Second proposed guideline: Lecturers' skills

Any lecturer employed at the NWU should make sure that they improve their skills of using the AV technology in lecture rooms. This will minimise problems they encounter when they use the technology in the lecture rooms. The support staff need to offer training

courses and workshops to all lecturers at the NWU to advance the lecturers' skills because not all are up to date with the latest AV technology devices. A lecturer needs to be a student of the support staff so that they also learn of other devices they can use in their classes. The students also come with new ideas to class; this is another way for lecturers to learn and improve their skills in the AV field and how they can integrate and incorporate them in class.

5.3.3 Third proposed guideline: Audio-visual technology challenges

Lecturers must indicate to the support staff the challenges they encounter when they make use of the technology in lecture rooms. These need to be clearly explained so that support staff can diagnose the problem and find a permanent solution for it. Support staff need to offer adequate technical support for lecturers in lecture rooms and make sure that lecturers know what to do and where to go if they have problems. This is one of the major problems that affects the effective use of technology in venues because lecturers do not want to lose the limited time they have to teach. Lecturers should not find themselves wasting their time in class or postponing their classes due to AV technology challenges. This means that support should have a backup plan in case a problem cannot be fixed immediately so that the lecturer can continue with their class.

5.3.4 Fourth proposed guideline: Improvements on audio-visual technology

In any organisation, there is room for improvement on AV technology because technology keeps evolving and improving. Support staff should make provision for this in their plans, and lecturers must also keep their skills up to date with the ever changing technologies. This is one of the major guidelines that the researcher proposes to the support because improving and upgrading their technology will encourage lecturers to make use of the technology in lecture rooms. The ever improving technology means that the NWU support must keep up to date with all the relevant devices that lecturers have or would like to have installed in their lecture rooms. This means that every lecturer will be interested in learning to use the new AV technology installed or upgraded in lecture rooms. Upgraded technology in lecture rooms means that the NWU will have state-of-the-art lecture rooms used for teaching and learning while making sure that lecturers deliver preeminent content to students using their exceptional technology skills.

The next section discusses the reflections of the study.

5.4 RESEARCH STUDY SUMMARY

Audio-visual technology plays a significant role in the modern day education and life. Research shows that the use of technology in lecture rooms has had a positive impact on students' lives and academic progression. The use of AV technology in lecture rooms needs to be transformed in order to reflect the adjustments in an academic environment to be relevant to the ever improving academic world. This can be obtained by making sure that there is appropriate and satisfactory technology to stimulate student engagements and participation in lecture rooms while the lecturer delivers the relevant knowledge content. However, this technology must also be used effectively.

It has been indicated that lecturers' and teachers' attitudes determine the use and non-use of the technology in their lecture rooms. According to Laurillard (2013:192), university lecturers are looking for techniques to increase their understanding and use of technology in class. This is to improve their own personal gains of teaching efficiently and their students' learning. Lecturers play a huge role in engaging students whose persistence and interest in the use of AV technology have not yet been developed (Pajares, 1992:318). The academic environment needs to be flexible enough to allow lecturers to explore the different technologies that they think will add value to teaching and learning in lecture rooms. Research shows that the effective use of AV technology depends on many aspects such as, but not limited to, teacher motivation and interest, availability of resources, technical knowledge and the students' responses towards the technology (Mathew & Alidmat, 2013a:87).

In today's fast-paced digital world, students are frequently using technological systems for communicating, learning and acquiring information. Most of the students are still faced with conventional traditional technology installed in lecture rooms while they use up-to-date modern technological devices in their daily lives. This results in students being discouraged to participate in class because they typically have to listen to the lecturer without getting an opportunity to interact. Most students in institutions of higher learning learn and think differently due to their experiences and use of advanced digital technology. The 21st century student's requirements have changed significantly while the educational systems and methods often remain the same. So, many students are hesitant

to take programmes that still use only the traditional methods for learning. As such, lecturers must strive to effectively use all available technology to actively engage students in class.

The study was undertaken to gain an understanding of the lecturers' opinions, views, knowledge and perspectives of the AV technology installed in lecture rooms at NWU. This potentially included (by invitation via a formal NWU channel) all lecturers employed part time or full time using the NWU lecture rooms facility to conduct their classes. Data collected from participants and information from literature were included in the guidelines, and these guidelines include recommendations on how lecturers can use currently installed AV technology effectively in their classes. The study's objectives were achieved, as per the chapters of this dissertation:

Chapter 1

The researcher gave the background of the research study and how it relates to the real world in order to motivate carrying out this study. A brief overview on key concepts were provided. The research problem was formulated as well as the research objectives and research questions. The methodology, empirical method, and ethical considerations of how the study was to be carried out to address the research objective were also presented.

Chapter 2

The literature review including that of the key concepts of the study was concluded to create a shared understanding. Different AV technology equipment were identified and explained, their purpose, importance and barriers affecting the implementation of the technology in classrooms were discussed. Guidelines were defined and the key principles of developing a guideline were introduced. This partially addressed the theoretical objectives. The theoretical objectives were addressed in full by both Chapters 2 and 3.

Chapter 3

This chapter introduced theoretical research frameworks and paradigms and outlined the approach that were followed to conduct this study. The data collection and analysis processes as per the framework and paradigm were presented. The selection of

grounded theory as a suitable research method and how it was applied to the study were explained. This partially addressed the theoretical objectives. The theoretical objectives were addressed in full by both Chapters 2 and 3.

Chapter 4

This chapter addressed the primary objective of the study through data collection and analysis processes. The research method and steps followed to conduct the empirical study were presented and the results gained from the interviews and literature were explained. The primary research objective of the study was achieved as the researcher applied the data collected and insights from the literature to understand the lecturers' perspectives on the AV technology installed in lecture rooms, and how it can be improved on for better use at NWU. The recommended guidelines for the effective use of AV technology in lecture rooms at NWU, based on the insights gained from the collected data and the literature were summarised in Section 5.3.

5.5 REFLECTIONS

This is a reviewing section of the study where the researcher makes reflections on what was learnt from the research. The researcher reflects on the research objectives, research questions, literature review, methodology, interpretive research principles, contributions, study limitations and ethical considerations of the study.

5.5.1 Research objectives

The research objectives of the study were stated and explained. This Section indicates how these objectives were met in the process of developing guidelines. The developed guidelines are explained in Section 5.3. Proposed guidelines address the primary objective of the study since the process of developing effective guidelines was followed as indicated in Chapter 2. The main objective was to develop guidelines for lecturers on the effective use of AV technology in lecture rooms. The guidelines are developed for lecturers only.

The theoretical objective of the study was met when the researcher gained and demonstrated an understanding of the key concepts of the study. The literature review conducted gave the researcher an insight of the different concepts that arose, those

related to the main concepts of the study and those that affect the study literature. Some of the concepts were directly and indirectly related to the key concepts of the study. These were then taken into consideration when concluding on the literature that is presented for this study.

The researcher gained and understanding of the lecturers' perspectives on the AV technology installed in lecture rooms. This was met through the process of interviews where each lecturer expressed their views and opinions on the AV technology installed guided by the interview questions. The lecturers also mentioned ways in which the AV technology in lecture rooms can be improved and enhanced for their respective usage. In the development of guidelines, the researcher used both the data collected from the lecturers and the gathered literature in making sure that empirical and theoretical objectives of the study are met.

5.5.2 Research questions

The objectives of the study were achieved when the research questions were answered and addressed by the participants' responses and the literature. The lecturers' perspectives on AV technology installed in lecture rooms was met during interviews when they answered question number 9 and 10, Annexure B. These questions allowed a lecturer to express their opinions on how does AV technology installed in lecture rooms affect the quality of the work they teach and how has it improved their teaching experience. Question number 12, asked the lecturers to recommend improvements and enhancements that can be made to the current setup in lecture rooms. Lecturers had recommendations that can be implemented in classes so that AV technology can be effective for them. The researcher believes that all the research questions were answered and addressed hence the research objective were also met.

5.5.3 Literature review

The literature review indicated that there are a lot of challenges in different organisations regarding the use of AV technology. In terms of teaching and learning, the effective use of AV technology in classrooms is impacted on by a lot of factors that include but are not limited to lack of training, resistance to change, availability of working technology resources, inadequate technical support and lack of teachers' confidence to use new technology.

It was discovered that the new generation of students is digitally savvy; hence, the learning environment should try to accommodate them so that they can be actively engaged in the learning process. The evolving change of learning environment is persuaded by lecturers because they have to incorporate their teaching methods in making use of the AV technology to deliver the knowledge content to the students. Lecturers should learn to adapt to the ever changing world of AV technology at institutions of higher learning to accommodate the new generation of students they get.

5.5.4 Methodology

The aim of this section is to reflect on the methodology used and the suitability thereof for this study. Chapter 3 explained the different methodologies, including the appropriate one for the study, and the limitations. The study was intended to answer the research objectives and question, as indicated in Chapter 1 Section 1.4, by providing a descriptive analysis and understanding the lecturers' experiences, views, opinions and perspectives on AV technology installed in the NWU lecture rooms. In order to achieve the objective, a qualitative research approach was considered to be suitable because it comprises an interpretive research paradigm that is considered to be subjective. An inductive approach using grounded theory was applied to this study in trying to understand the perspectives of the lecturers.

An inductive approach includes collecting data and converting it to useful information by creating codes, categories, themes and grouping themes to develop guidelines (Marshall & Rossman, 2014:200). Theories were formulated and created using the grounded theory strategy in the study because data was collected directly from the participants' in their background settings. A purposeful sampling method was used for possible participant selection, meaning that all NWU lecturers were regarded as part of the sample and they had to voluntarily accept to be involved in the study (Boeije, 2002:392; Palinkas *et al.*, 2015:533). Interviews continued until data saturation.

An interview process between the researcher and an interviewee took place in a semi-structured format, as described in Chapter 3. A qualitative data collection technique was used to collect data from eight lecturers from three campuses of one institute. The use of a CCM assisted to analyse the grounded theoretical data collected from the interview

transcripts. CCM using Atlas.ti was used to identify patterns that explained the lecturers' perspectives on AV technology.

5.5.5 Interpretive research principles

The principles of interpretive research were introduced and applied in Chapter 3 Section 3.2.2 to test for the trustworthiness of the study. Rigorous tests were done through data collection and the CCM for data analysis against the principles of interpretive research. This sub-section reflects on how the principles were achieved in the study.

The fundamental principle of the hermeneutic circle

This principle was achieved by attaining and understanding the perceptions of the lecturers, as participants, through the use of interviews for data collection. The perspectives of the participants were iterated and transcribed for their expressed experiences, views and opinions. The researcher knows and understands that this is a crucial principle that determines how the rest of the principles are carried out.

The principle of contextualisation

The researcher explained the purpose and motivation to conduct this study to the participants before they could participate in the study. The use of specific questions during the interview process enabled the researcher to gain more historical knowledge from the intended participants regarding the use of AV technology in lecture rooms at NWU. Understanding the participants' views was critical for interpreting the data collected.

The principle of interaction between the researchers and the participants

The researcher used open-ended questions in the interviews to interact with the participants for data collection. He made sure that participation in the interview was not compromised or guided. To achieve this, the researcher asked the same questions to all the participants and only asked follow-up questions (allowed in semi-structured interviews) where the response was not clear. The interview questions that were asked to all participants are attached in Annexure B.

The principle of abstraction and generalisation

The first and second principles were applied continuously at this point in order to find concepts and patterns that represent the same thoughts from the participants' collected data. After each interview analysis, the researcher had to cluster the thoughts and perspectives in order to find the idea that best represents the coded data. The data was coded, grouped and categorised to develop themes before developing guidelines.

The principle of dialogical reasoning

This was achieved by comparing the data from the literature review with the findings of the study. The developed themes supported the data that was gathered in the literature review. The researcher did not ignore any data interpreted from the participants because it is important in proving or disputing the data from the literature. The researcher represented all the views and expressions of all participants.

The principle of multiple interpretations

Each participant expressed their views and perspectives regarding the use of AV technology in lecture rooms. The researcher combined these views and perceptions to find the similarities or conflicting interpretations. Based on this study, most of the participants had supporting multidimensional meanings regarding the use of AV technology in lecture rooms.

The principle of suspicion

Achieving this principle started with the data collection process. The researcher was consistent in conducting the interviews, asking the questions and making sure that data is not altered or modified. The researcher made sure that his prior background regarding the use of AV technology in lecture rooms does not impact and affect the responses from the participants. The study findings are reported by means of conceptualisation of the participants' perspectives and the literature in Chapter 2 and are not the views of the researcher.

5.5.6 Contribution of study

The research contributed to the development of guidelines for effective use of the AV technology in lecture rooms at NWU. The recommendations developed after the data analysis are meant to contribute to the existing body of knowledge on the use of AV technology at institutions of higher learning.

5.5.7 Study limitations

One of the limitations for the study is the number of participants that took part in the research. The study was conducted in one institution that has three campuses and this cannot be generalised to all other institutions in South Africa. The number of lecturers who participated in the study was limited, but interviews were conducted until data saturation was reached. Purposeful sampling was used. The number of participants was sufficient to reach data saturation and demonstrate the research process.

5.5.8 Ethical considerations

This sub-section explains all the processes that were followed to make sure that the study adheres to the ethical rules of the NWU. The researcher applied for the NWU ethics clearance number from the FNAS RERC and it was approved. Application to conduct interviews with the employees of the NWU was sent to the NWU RDGC and permission was granted. All the participants that took part in the study were volunteering and they were given consent forms to sign before the interview process could take place.

All participants were treated with respect and their identity and information they provided were also kept confidential by the researcher. The researcher explained to the participants that they can get access to their transcribed data upon their request to make sure that the data is correct. All the necessary NWU ethical processes were followed to make sure that the researcher adheres to the rules and regulations for conducting a research study. A copy of the participation consent form that had to be signed is attached in Annexure C.

5.6 RECOMMENDATIONS FOR FUTURE RESEARCH

Future research can be done at other institutions in the country and the results can be compared to other institutions in Africa and the rest of the world. Only one group of

lecturers was used to conduct this study, and their demographic information, like age and gender, was not considered in the data collection and analysis processes. Future research can focus on other groups at an institution, i.e. management, support staff, and students to explore different age groups, genders and management positions that are affected by the effective use of AV technology.

5.7 SUMMARY

This chapter gave a summary of the research and the reflections on the study. Recommendations were made coming from the findings of the literature review and the responses obtained from the interview results. A set of guidelines was developed to achieve the main objective of the study. Recommendations for future research were also identified.

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Annexure A: Audio-visual technology definitions

Smart whiteboard

SMART Board is an interactive whiteboard that has a large touch-sensitive board that uses sensors for detecting user input equivalent to normal PC input devices, such as mice or keyboards. SMART boards usually come with digital writing utensils that use digital ink instead of the traditional whiteboard markers. The digital ink work by using an active digitiser that controls the PC input information for writing capabilities such as drawing or handwriting.

Clickers

Clickers are any of various devices operated with a button that makes a click sound when pressed.

Computer / Laptop

A computer is a machine or device that performs processes, calculations and operations based on instructions provided by a software or hardware program. It is designed to execute applications and provides a variety of solutions by combining integrated hardware and software components.

A laptop is a portable personal computer powered by a battery, or an AC cord plugged into an electrical outlet, which is also used to charge the battery. Laptops have an attached keyboard and a touchpad, trackball, or isometric joystick used for navigation. A laptop also has a thin display screen that is attached and can be folded flat for portability.

Document camera

A real-time image capture device used to display an object to an audience. A document camera is similar to an overhead transparency projector but offers much more flexibility and eliminates the need for the creation of overhead slides. A document camera allows users to project documents and other objects on a screen or television.

Microphone

A microphone is a device that translates sound vibrations in the air into electronic signals or scribes them to a recording medium. Microphones enable many types of audio recording devices for purposes including communications of many kinds, as well as music and speech recording.

Pointers

A long, tapering stick used by teachers, lecturers, etc., in pointing things out on a map, board, screen, or the like.

Projector

A projector is an output device that projects an image onto a large surface, such as a white screen or wall. It may be used as an alternative to a monitor or television when showing video or images to a large group of people.

Sound / Speakers / Music

Speakers are transducers that convert electromagnetic waves into sound waves. The speakers receive audio input from a device such as a computer or an audio receiver. Speakers are one of the most common output devices used with computer systems. Some speakers are designed to work specifically with computers, while others can be hooked up to any type of sound system. Regardless of their design, the purpose of speakers is to produce audio output that can be heard by the listener.

Universal Serial Bus (USB)

A Universal Serial Bus (USB) is a common interface that enables communication between devices and a host controller such as a personal computer (PC). It connects peripheral devices such as digital cameras, mice, keyboards, printers, scanners, media devices, external hard drives and flash drives. Because of its wide variety of uses, including support for electrical power, the USB has replaced a wide range of interfaces like the parallel and serial port.

eFundi

eFundi is a learning management system, an open source product developed in the USA. This system makes it possible that information can be transferred between NWU and other universities in our country and the world.

Internet

The internet is a globally connected network system that uses TCP/IP to transmit data via various types of media. The internet is a network of global exchanges – including private, public, business, academic and government networks – connected by guided, wireless and fibre-optic technologies.

J-Pad

J-Pad is a unique, highly intuitive joystick interface providing comprehensive switch access to a device's functions. J-Pad has an integral rechargeable battery which can be charged via any USB socket.

Kahoot

An online classroom review game that students join using smartphones to answer questions. Kahoot uses a point system that rewards correct responses and response speed.

Lecture capture

Refers to the technique used for video recording of complete class in session. The technique consists of using a camera at one end of the classroom that will capture everything that happens in a class, from beginning to end.

Module specific software

This is a software intended for use to a specific module at the university. E.g. A geographic information system (GIS) is a software designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data. GIS applications are tools that allow users to create interactive queries, analyse spatial information, edit data in maps, and present the results of all these operations.

Padlet

Padlet is an online virtual bulletin board, where students and teachers can collaborate, reflect, share links and pictures, in a secure location.

Skype

Skype is a voice over Internet Protocol (VoIP) software application used for voice, video and instant messaging communications. Skype software allows user to make calls, video calls or engage in chat over the Internet. Unlike other similar services, Skype calls use peer-to-peer technology rather than the client-server system.

YouTube

YouTube is a popular video sharing website where registered users can upload and share videos with anyone able to access the site. This platform allows videos to be embedded and shared on other sites.

Videos

Visual multimedia source that combines a sequence of images to form a moving picture. It's a visual media product featuring moving images, with or without audio, that is recorded and saved digitally or on videocassette.

Interactive software (Facebook, Twitter, Prezi, etc.)

An interactive software is a computer software program that requires user interaction to operate. This interaction could include inputting information, modifying information, managing information or otherwise manipulating data.

Annexure B: Interview Questions

Introduction

Thank you for granting me this opportunity to interview you. I am Chuku Taole from North West University, Vanderbijlpark campus. I am currently busy with my Master studies in Computer Science and Information Systems. My research study is based on developing guidelines for the effective use of audio-visual technology in lecture rooms at NWU.

Your answers will be treated as confidential.

You will not be identified on any information that will be published.

All the information will be kept safe and the information will be utilised for the intended purposes only.

Do you have any questions related to this study before we can start with the interview?

1. What audio-visual (AV) technology do you use in lecture rooms for teaching?
2. What do you use the technology for?
3. How often do you make use of the AV technology?
4. To what extent did you need help for the first time when you used the technology?
5. To what extent do you need help when you use the technology now?
6. How often do you have to ask for assistance when you use the AV technology?
7. What aspects do you need assistance with repeatedly when you use the AV technology?
8. To what extent does the flexibility of AV technology allow you to do what you want to do in your class?
9. How does the use of AV technology affect the quality of the work you teach?
10. To what extent does the use of AV technology impact your teaching experience?

11. How does the use of AV technology influence the students' participation and interaction?

12. What do you think can be done to improve the current AV technology in lecture rooms?

Annexure C: Participant Consent Form

CONSENT FORM PARTICPATE IN A RESEARCH STUDY

Name and contact details of researcher: David Chukuchane Taole

Email address: Chuku.Taole@nwu.ac.za

Contact number: 016 910 3253

TITLE: Guidelines for the effective use of audio-visual technology in lecture rooms at North-West University

Purpose of Study: To develop guidelines that will improve the effective use of audio-visual technology installed in lecture rooms at an academic institution.

Please take note of the following:

- I understand that my participation is voluntary and that I am free to withdraw at any time, without any adverse consequences or academic penalty.
- I understand that this study has been reviewed by, and received ethics clearance from, the Faculty of Natural Sciences and Agriculture Vaal Campus, Ref No FNAS-VC-20180514-1.
- The study involves anonymous interviews. No information about your identity will be published in the findings.
- Participants' answers and the findings will be treated as strictly confidential.
- I give permission to the researcher to report the findings in the dissertation, conference papers, articles and academic purposes only.
- I consent to being audio recorded.
- I am aware that the researcher is an employee of the institution and forms part of the category of employees being researched.

- I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
- You may contact me or my study supervisor, Dr Carin Venter, Carin.Venter@nwu.ac.za if you have any questions or comments regarding the study.

Your signature below indicates that you agree to be a participant for the study and that you have read and understood the information provided, subject to the confidentiality agreements above.

Participant Name	Date	Signature